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The Mining Journal

LONDON, NOVEMBER 4, 1960

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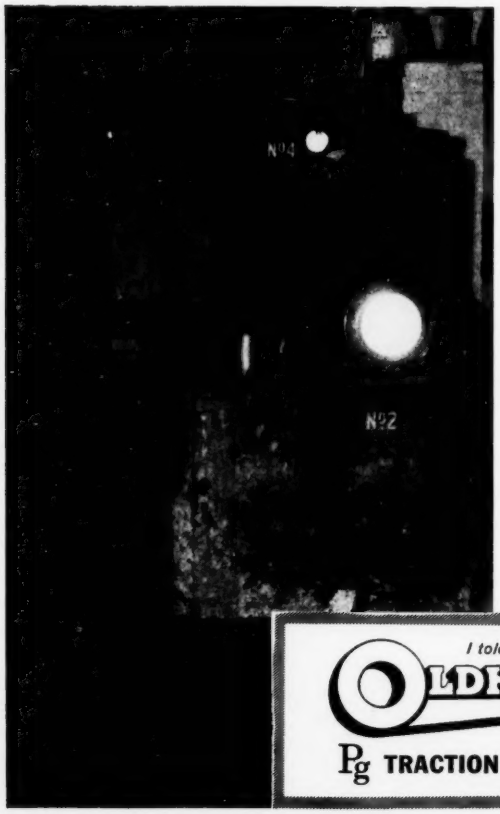

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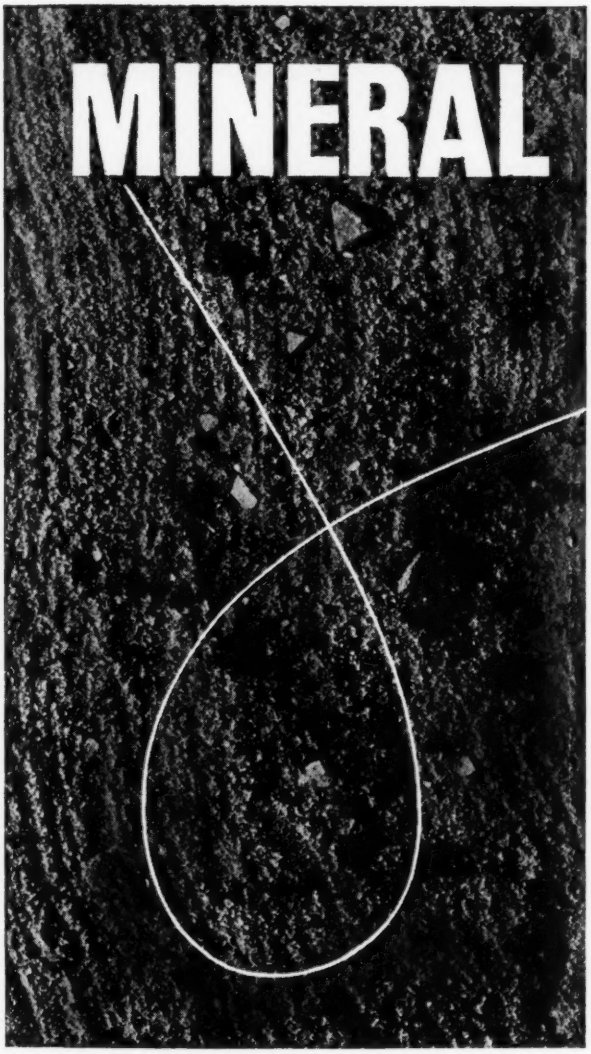

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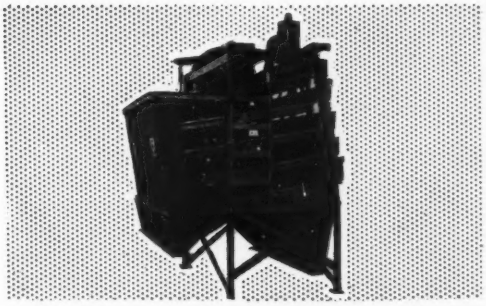

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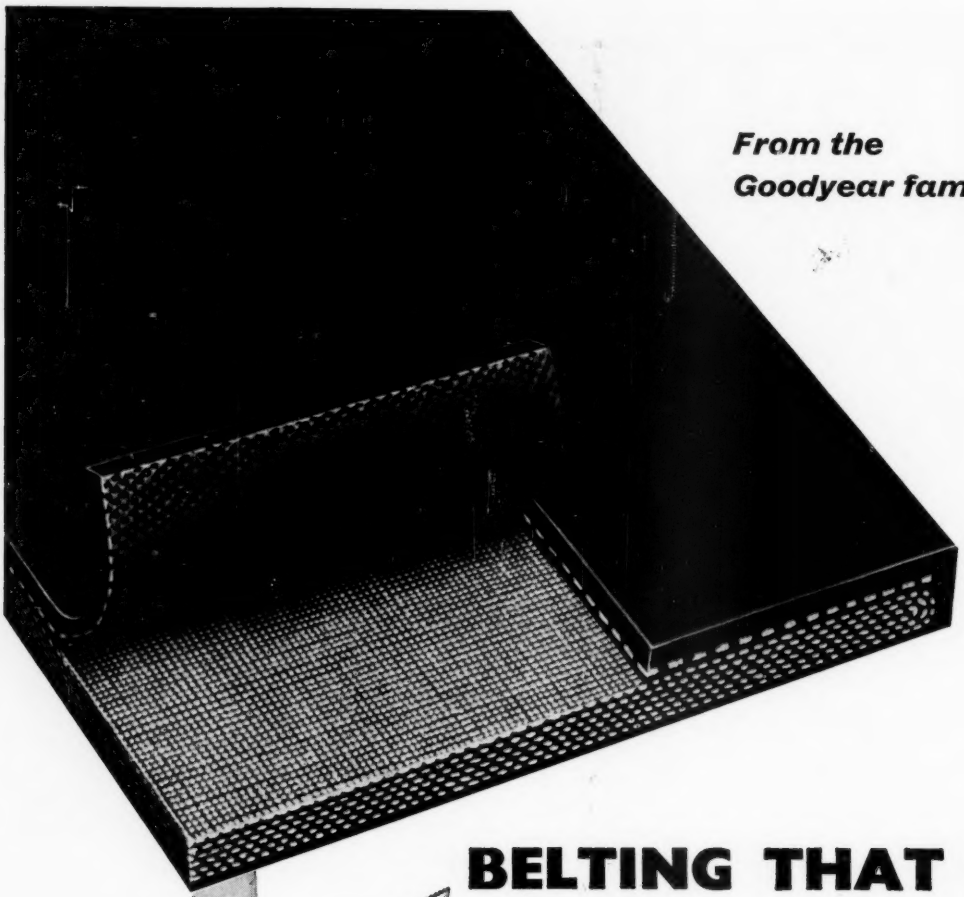

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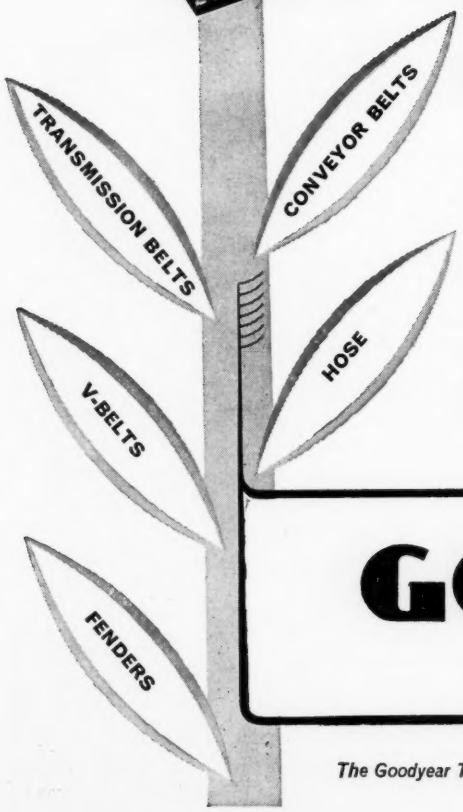

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Photograph by permission of the National Coal Board. Trunk conveyor, 1100 yards between centres, at Haig Colliery, Cumberland. 42 inches wide, 4 ply CN80 (nylon weft) belt by Barrow Hepburn & Gale, Mitcham.

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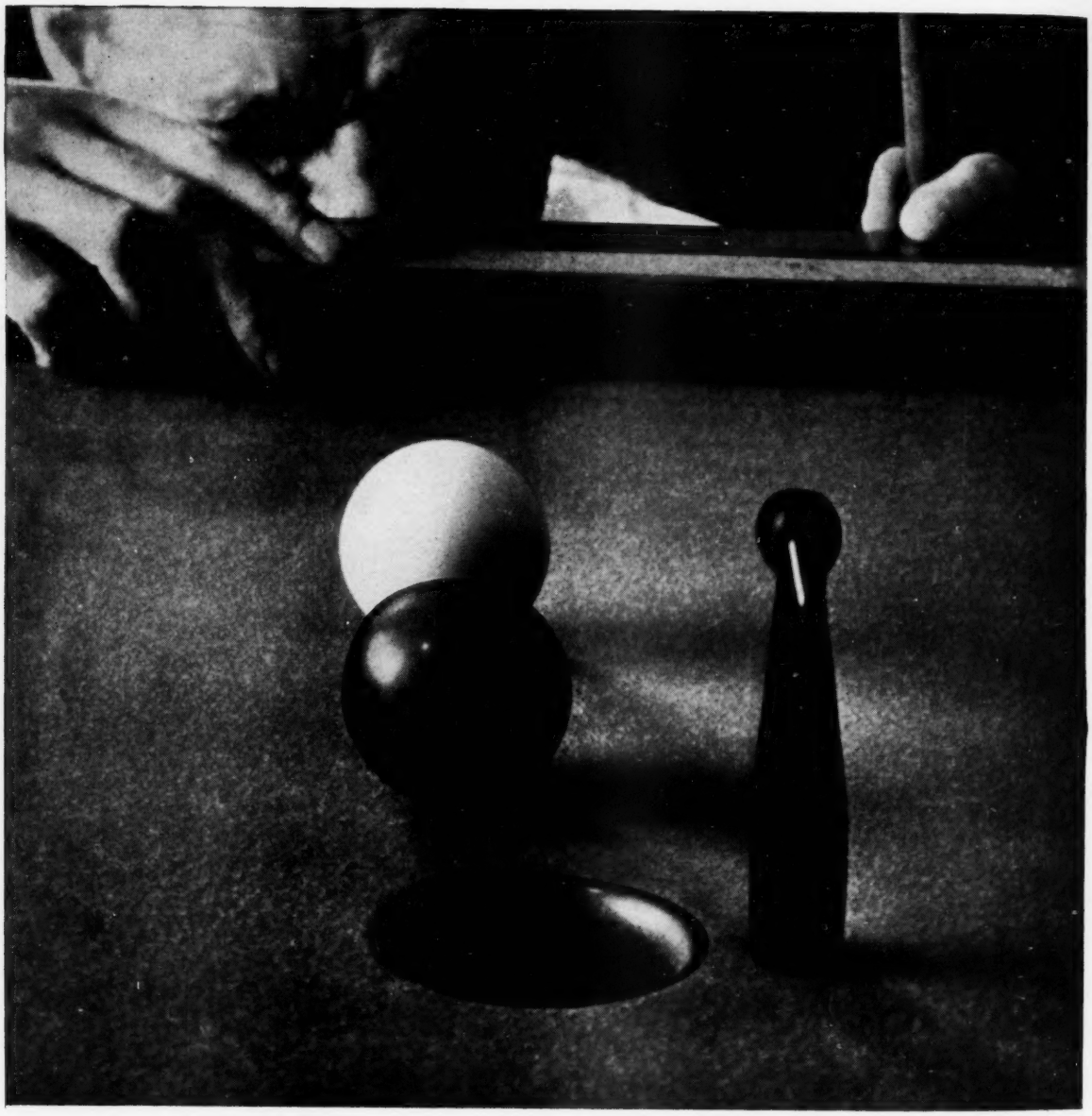

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The Mining Journal

London, November 4, 1960

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Steel's Next Fifteen Years

LAST year, despite a standstill lasting 116 days at the big American steel plants, world steel production rose to the new peak of 318,000,000 tonnes. Outside the United States, indications point to another record year in 1960.

Crude steel production in Europe amounted during 1959 to 172,000,000 tonnes, an increase of 14,000,000 tonnes or 9 per cent over the total for the previous year. Of the European Coal and Steel Community countries, Western Germany had the biggest rise, its output of 32,448,000 tonnes comparing with 28,930,000 tonnes in 1958. Eastern Europe produced 79,300,000 tonnes of crude steel in 1959, an increase of 7,000,000 tonnes.

A study issued this month by the United Nations Economic Commission for Europe points out that, although Western European countries together accounted for 75 per cent of world steel exports, the extraordinary upswing in Europe's steel industry, as observed during 1959, originated and is based on the home markets. The logical decline in overseas exports, which must be expected during 1960, should not, therefore, have a retarding influence on Western Europe (in the first six months E.C.S.C. countries produced a record 36,000,000 tonnes of crude steel).

In the United Kingdom total output of crude steel is expected to rise to about 25,000,000 l.tons this year from 20,200,000 tons in 1959. The rate of expansion in capacity, which in the past has been running at about 1,000,000 tons a year, has now been stepped up to about 2,000,000 tons, indicating outputs of 29,000,000 tons in 1962 and 34,000,000 in 1965.

The United States steel industry is currently operating at little more than half capacity and hopes of a significant fourth-quarter upturn have begun to wane. Nevertheless the failure of the expected recovery in demand to materialize and the uncertain outlook for the national economy in the coming year have so far made little difference to the industry's capital outlays. The total amount budgeted for mill expansion and new equipment in 1960 amounted at the beginning of the year to some $1,600,000,000. A survey conducted last month by *American Metal Market* indicated that capital outlays were continuing to run at a near record level.

Elsewhere in the world the expansion of steel production continues to be accorded the highest priority in long-term programmes of economic expansion. China, now the world's seventh largest producer of iron and steel, hopes to be fifth by 1965. India is still raising its sights. The South African Iron and Steel Corporation (Iscor) is about to start a new expansion programme, extending over 12 years and costing £270,000,000. South Africa's requirements of those steel products now being manufactured by the corporation are expected to call for between 4,350,000 and 4,500,000 ingot tons in 1972, which means that by that date Iscor will have to increase its annual steel production by between 2,000,000 and 2,150,000 ingot tons.

This robust confidence in the continued expansion of steel consumption, despite the inroads of aluminium, plastics, concrete and other materials in steel's traditional markets, is supported by the conclusions reached in a novel study of the world steel market in 15 years' time. Entitled "Trends and Problems in the European Steel Industry", it was published by the United Nations Steel Committee in Geneva and is the subject of a critical analysis in the current issue of *Steel Review*, the quarterly publication of the British Iron and Steel Federation.

From examination of the whole history of world steel consumption, from the late nineteenth century until the present day, the authors have formulated a law of growth, namely that the rate of increase of steel consumption tends to diminish, the higher the absolute level of consumption that is reached. In other words, as the world and its individual countries become economically more advanced, their need for steel becomes less urgent. At the outset of capital development, a country is intent on the construction of bridges, railways, docks, public buildings, etc., all of which are heavy consumers of steel. As its economy matures, it proceeds to the manufacture of machinery, motor cars, razor blades and watches, all requiring a small unit weight of steel; as these industries become more efficient they waste less of the steel they use, and so demand is further reduced. Finally, there is the natural tendency to switch to newer materials. Over the next fifteen years, however, this effect is not expected to be serious, since the main competing materials, if they developed at the fastest rate ever attained by steel itself, would not capture more than 8-9 per cent of total steel consumption by 1972.

Expressing their law of growth as a mathematical formula, the authors used this in turn to draw a curve of theoretical growth of consumption, which was then superimposed on the real historical curve of consumption. The two curves were found to correspond very closely over the whole period, except where development was interrupted by wars or severe economic crises. The theoretical curve was accordingly projected forward to 1972-75, and a figure for consumption at the latter date was thus predicted. Assuming that no wars or severe depressions occurred in the interval, it was predicted that in 1975 world steel consumption would amount to some 625,000,000 tonnes compared with some 300,000,000 tonnes in 1959.

The rate of increase in the steel consumption of every country between 1950 and 1957 was then plotted in relation to the country's actual level of consumption in 1950. This produced a pattern which could be resolved mathematically into two lines of average increase, one for fast-moving and one for slower-moving countries. These two lines thus represented the average increase rates by countries from 1950 to 1957 for a world consumption of 297,000,000 tonnes in 1957. By moving the lines until they corresponded with world consumption of 625,000,000 tonnes, a series of future increase rates was produced. The position of the countries on or near the lines was then determined by an empirical judgement of their general economic circumstances.

The U.K. estimate of 32,000,000 tonnes in 1972-5 compares with 21,000,000 tonnes recorded in 1959 and implies an average rate of increase only slightly lower than that maintained in the years 1950-57. For Western Germany, however, a considerable slackening in the rate of expansion is foreseen and a consumption of 36,000,000 tonnes in 1972-75 is forecast. Outside Europe, the United States, though credited with an expansion rate of only 1.6, will still be much in advance of the U.S.S.R.—145,000,000 tonnes against 113,000,000. A carefully qualified forecast for China indicates a rise to 53,000,000 tonnes. In general, the world picture suggests that demand between regions will even up.

With an assumed world production of steel more than double today's total, a very large growth in the supply of raw materials must also be presupposed. Although abundant scrap resources are foreseen for 1972-5, they will not constitute a higher proportion of total raw materials used. The pig iron to scrap ration will remain virtually unchanged. The world will remain as dependent on iron ore resources as before and producing countries will see their dependence on foreign sources increased, with consequential effects on the location of their steel industries.

On the whole, the study foresees no difficulty in the supply of iron ore, provided development plans are made in good time. It does, however, indicate the possibility of an over-development of iron making capacity if the upsurge of scrap in the late 1960's is not given due consideration.

Against this background of rising steel consumption and demand the enormous effort currently being devoted to the search for and development of iron ore resources, despite the present temporary recession in the United States steel industry, is seen in its true perspective. Even if, as the authors have concluded, the growth of the world steel industry is gradually slowing down, producers of iron ore and ferroalloy metals can look forward to steadily expanding markets in the years ahead. Moreover, it by no means follows that, so far as the anticipated slowing down of expansion is concerned, past trends are necessarily an accurate pointer to future prospects. As *Steel Review* points out, it is premature to assume that the consumption of steel, and the growth of economy generally, will eventually come to rest at a stable level. Some unforeseen factor, such as the release of resources at present locked in rearmament or world-wide political stabilization, might well give an entirely new impetus or orientation to the world economy, which could open up still wider horizons for the steel industry and, indeed, for producers of every ore and metal.

MINING IN ISRAEL'S DEVELOPMENT PROGRAMME

A detailed survey on Israel's future development projects in this field has been presented to this year's session of the Technological Advisory Board in Jerusalem by Mr. M. Bader, Director-General of the Ministry of Development, which jointly with the large development companies mainly situated in the Negev region, has already drawn up plans to cover the period 1960/1965.

As regards the Dead Sea Works in Sodom, plans envisage large scale expansion of the manufacture of potash, bromine and various bromine compounds, magnesium and magnesium compounds, tetra-bromethane, etc These items are included in the application for a loan submitted to the World Bank some months ago. Negotiations are still under way, but experts of the Bank have recommended the scheme. Mr. M. Bader disclosed in this context that the well-known engineering consultants Arthur De Little have rendered a favourable and unqualified interim report on its value and economic feasibility.

Mr. Bader has further stated that, in partnership with an American concern, a magnesium plant is to be built by Dead Sea Works Ltd. The investment required will be $3,000,000, of which 50 per cent will be supplied by the U.S. partners.

Our correspondent in Israel forwards the additional information that investments in the potash development

programme will amount to I.£60,000,000 (approximately £12,000,000 sterling). The plan envisages construction of dykes to a total length of about 100 sq. km. Within the scope of the four-year plan, the installations gradually would increase annual output of potash to some 600,000 tons. According to Sir Ben Lockspeiser, reserves of potash in the Dead Sea will last for many generations. Annual consumption is rising by 500,000 tons and, since no major expansion in potash output elsewhere is anticipated before 1962, world prices are rising. Israel is already providing markets in five continents.

The Israel Mining Industries Ltd. plan to double the annual capacity of their Timna Copper Works in the southern Negev to 14,000 tons of 100 per cent metallic copper, including production of blister and electrolytic copper. Prices and marketing possibilities call for quick action. In the area of Har-Ramim, in Galilee, Israel Mining Industries intend to get down to work on the iron mine, owing to the fact that, according to Mr. M. Bader, it has been conclusively demonstrated that the cost is less than any ore imported from abroad.

In the Negev phosphate industry, the setting up of two plants is envisaged, in addition to that already existing at Oron which, however, should be extended. The two new plants will consist of a factory for the upgrading of phosphate rock up to 38 per cent P_2O_5 content by means of flotation and calcination, having an annual capacity of 200,000 tons, and of a soda-ash factory with a capacity of 60,000 tons a year. It is learned that an American firm, one of the largest in the field, is prepared to become, under certain conditions, a partner in such an enterprise, the establishment of which naturally depends on the erection of the upgrading installations. Under further discussion is a plant for the extraction and calcination of flint clay and an alumina-cement plant.

The implementation of such plans, together with others outside the mineral industries, will require an investment of I.£687,000,000 (approximately equal to £137,500,000 sterling), according to official estimates. Sixty-nine per cent of the total investment will be needed over the next five years, and the remainder in the course of the succeeding five-year period.

PROGRESS OF AUSTRALIAN RESEARCH

Some of the more important and interesting developments arising during the year from research being carried out in its laboratories and field stations are reviewed by the Commonwealth Scientific and Industrial Research Organization in its twelfth annual report, C.S.I.R.O. 1959-1960. Among them are several relating to the discovery and processing of minerals.

C.S.I.R.O. has assisted in the exploration of the extensive newly discovered oolitic iron formations of the Northern Territory. Microscopical examination of outcrop specimens, and of selected sections of drill cores from these occurrences, has revealed their texture and mineral composition. This led to the prediction that in the deeper-lying sections of the formation, carbonate minerals would take the place of the silica cements found in surface and near surface sections. Subsequent drilling has confirmed this, the carbonate proving to be the iron carbonate, siderite. In the Roper Bar area the first occurrence in Australia of the iron silicate, greenalite, was found, permitting a new chemical analysis and giving new X-ray powder data for this mineral. The oolitic siderite formations of the Constance Range promise a significant addition to Australia's iron ore reserves.

The conventional method of making alumina is by the alkaline (or Bayer) process using bauxite as the source mineral. Progress was made during the year with the development of an acid process for producing alumina from various raw materials. Preliminary costing has been carried out for the new process using a flow sheet based on fully cyclic operation. Present indications are that reagent costs are considerably less than those for the conventional Bayer process, but that capital costs for the necessary corrosion-resistant equipment are high. Cheaper materials are being sought for constructing the plant, and improved chemical techniques will be adopted for the process to permit greater output for a given size of plant. The method shows promise of being readily applicable to clays and aluminous laterites, which cannot be treated economically by the alkaline Bayer process.

Work has been completed on a method for recovery of germanium from the flue-dust of coal-burning power stations in Australia. Up to half a ton per annum of germanium can be recovered for use in transistors and similar electrical devices should this become necessary. Germanium is currently valued at £150,000 per ton. Progress was also made in devising improved processes for the recovery of thorium compounds from Australian minerals and new methods for preparing thorium metal were developed. This work is related to the role of thorium in nuclear reactors.

BERYL IN UGANDA

An innovation in exploration methods, apart from the continued use of geochemical and geophysical methods by Kilembe Mines Ltd. and Unicorn Mines Ltd., was the introduction of a "berylometer" by the U.K. Atomic Energy Authority, states the Mines Department of Uganda Protectorate in its annual report for the calendar year 1959.

Output of beryl rose last year to 209.24 tons from 77.06 tons in 1958. At approximately 121 tons, the Ankole production was the highest district output for ten years and was a record. The Kigezi production at 88½ tons was also a record for that district. Most of the Ankole production came from areas of known beryl occurrence, which previously had not been developed. In spite of Ankole being an easier area to prospect than Kigezi, because it is more open and not so deeply dissected, the majority of prospectors involved were, up to this year, confining their attentions to Kigezi, but an apparent lack of surface deposits there and news of one or two newly opened deposits in Ankole led to an influx of prospectors into the latter district. A new beryl area, on the Kigezi-Ankole border, was discovered in Nyarushanje Gombolola, Kigezi.

The U.S. Atomic Energy Authority continued its work of assessing the beryl potential of south-west Uganda and has moved into central Ankole.

The buying agreement between the British Metal Corporation, through its Kikagati depot and the U.K. Atomic Energy Authority, by which the latter were to buy all Uganda ore at Shs. 225 per unit until March, 1960, was terminated at the end of 1959. Because of some buoyancy in world markets this has not yet caused a reduction in mining activities. Towards the end of last year, an offer to buy beryl for Shs. 250 per l.ton unit in 15-ton lots was made by a British firm on the basis of a six-month contract.

TESTING COLLIERY GEAR — I

Non-Destructive Testing of Colliery Gear b

THE radiographic method of non-destructive testing consists of the detection of the presence of internal defects in opaque bodies by the passage of X-rays and gamma-rays through them. By interposing the component to be examined between the point source of X- or gamma-rays and a photographic film, a shadow of the component can be obtained on the film when it is processed. There is the so-called photoradiographic technique, the most important of various techniques of detection, and the only one to be described here. Because of their short wavelength, X- and gamma-rays can penetrate materials opaque to ordinary light waves. They lose their intensity, however, as penetration proceeds. Where there is a flaw (such as a cavity) there is less absorption of the rays, with the result that a dark area is recorded on the photographic film.

The radiation may be obtained from an X-ray tube or from certain radioactive isotopes whose nuclear decay is accompanied by emission of gamma-rays. Both types of radiation consist of ultra-short-wave electro-magnetic vibrations; but they differ in that X-ray tubes give a continuous spectrum, whereas gamma-rays are in the form of line spectra with characteristic energy levels at various wavelengths depending on the substance from which they are emitted.

X-rays for radiography are generated by conventional tubes requiring 200 kV. or over for their operation. A 200 kV. X-ray unit is suitable for testing steel specimens up to 2 in. thick and a 2,000 kV. unit is required for about 10 in. thickness. This equipment is expensive and bulky whereas a gamma-ray source is cheap and easily transported. Thus the application of gamma-radiography to colliery gear has been much more extensive than that of X-radiography. However, for some purposes, X-rays have important advantages over gamma-rays. The exposure times are much shorter and better detail and flaw definition may be obtained.

Gamma-rays with much shorter wavelengths and consequently greater penetrating power are emitted from a number of artificially prepared radioactive materials. The naturally radioactive elements radium and radon (the radioactive gas emitted by radium) are available but have been largely replaced by the "artificial" radioisotopes obtained in the atomic energy projects.

Isotopes decay exponentially and it is usual to express their lives in terms of the time required for their strength to fall to half the initial intensity. The sources are in general available in cylindrical aluminium capsules in three standard sizes, 2 by 2 mm., 4 by 4 mm., and 6 by 6 mm., with various source strengths.

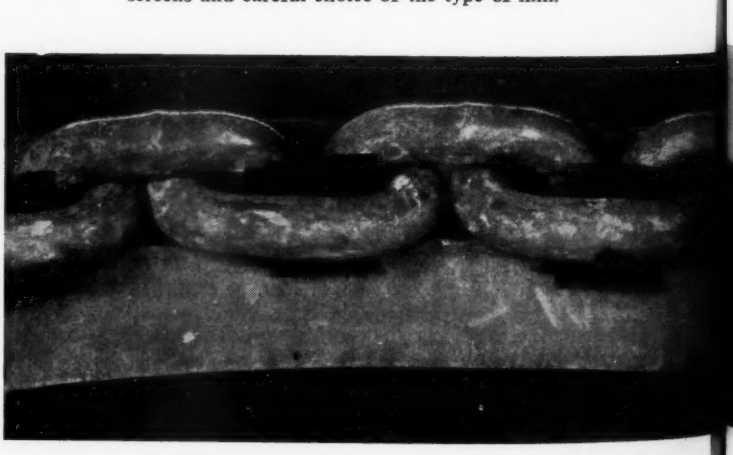
The strength or activity of the radioactive source is measured in terms of the curie (c) or millicurie (mc). This is a unit of radioactivity that expresses the rate of nuclear decay (total number of disintegrations per second). The quantity or dose of radiation is measured in terms of the rontgen (r) or millirontgen (mr). This is a measure of the energy available in the radiation rather than its intensity. The quantity of gamma emission from any one source depends on its gamma-ray spectrum. Thus different isotopes with equivalent radioactivity measured in curies emit different quantities and qualties of radiation.

Apparatus

The source of radiation—a radioactive capsule—is housed in a lead container. Various types of containers are available, some of which incorporate a conical opening, limiting the radiation to a defined divergent beam, and a hinged cover to close the aperture. Some containers provide for the protrusion of the source by remote control using a Bowden cable, so that radiation may be employed over an angle of 360 deg.

To obtain maximum definition of the film image the influence of the geometry of the radiographic set-up must be carefully considered. The sharpness of the image is better the smaller the area of the source and the smaller the specimen-to-film distance. The source-to-film distance is usually made short for gamma-ray exposures in order to minimize the exposure. Definition is impaired by fogging of the film as a result of stray or secondary radiation. This secondary radiation is usually filtered out by use of lead foil held in close contact with the film.

The contrast is dependent on the wavelength of the radiation. Gamma-ray radiographs have rather poor contrast but good results can usually be obtained by giving the exposure careful consideration and by the use of lead screens and careful choice of the type of film.



From left to right, across the bottom of these two pages, are shown examples of radiographic testing. At left are flexible cassettes used in the radiography of chain links. In centre is the radiograph of a steel link showing an electrode burn, while at far right is a cross section through the electrode burn indicated by radiography as shown in the centre picture

Radiographic Methods

Although a considerable amount of non-destructive testing is carried out by or on behalf of the coal mining industry, the application of the various techniques and the degree of inspection appear to vary from place to place. To determine the methods and techniques best suited to the industry and to make appropriate recommendations, a working party on non-destructive testing was set up by the N.C.B.'s Mechanical Engineering Conference. Bulletin 60/219, prepared by the working party, describes the various methods of non-destructive testing which are applicable to colliery equipment. The three main methods considered are radiographic, ultrasonic and magnetic. A description is also included of the penetrant method of detection. The article appearing herewith is the first of three presenting extracts from the Bulletin. Naturally not merely colliery, but all types of mining gear of a similar nature, could be tested by the methods described

Apart from ensuring that there are no interfering attachments to the specimen, no special preparation is necessary. In order to locate accurately in the radiograph such features as welds, etc., lead markers are placed on the object alongside but just clear of the outer edges of these positions. Identification of radiographs is very important especially, for example, when long welds demanding more than one exposure are being examined. Suitable symbols consisting of lead letters and/or numerals are attached to the cassette on the side facing the source. Permanent marking of the specimen provides reference points for accurate relocation of the position of each radiograph. This can be achieved by stamping or printing, and with the aid of accurate sketches.

There are several grades of film on the market, the choice depending on the quality of the radiograph desired. These films are of two types: one to be used with salt intensifying screens and the other with lead screens. The former is sensitive to fluorescent radiation, which is emitted when salt screens (calcium tungstate or zinc sulphide) are used. The other type is particularly sensitive to *B*-radiation, emitted by the action of gamma-rays impinging on the lead screens. For gamma-ray work intensifying screens are usually of lead. They consist of lead foil varying in thickness from 0.003 to 0.006 in. for the front screen and somewhat thicker for the back.

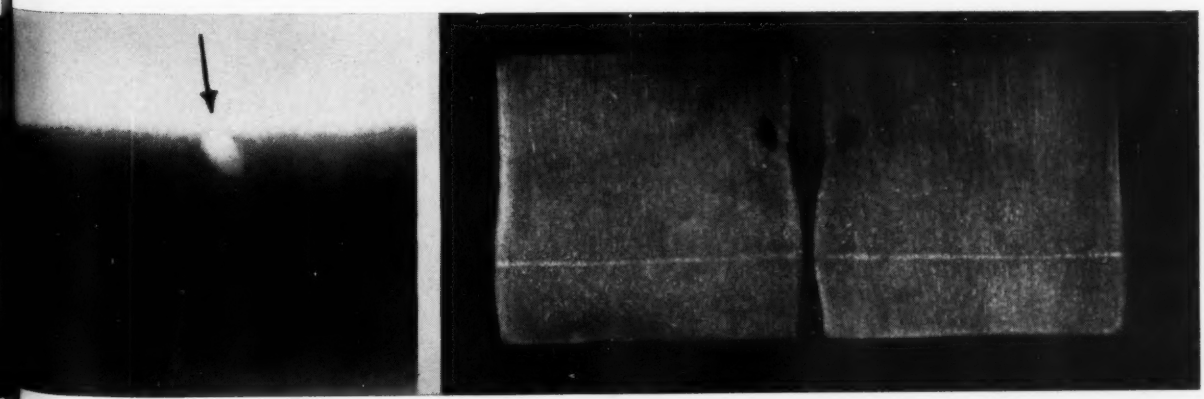
For tests on flat specimens, the films and intensifying screens are enclosed in rigid (e.g. metal) cassettes, which have sufficient flexibility to ensure good film-screen contact. Where the objects are curved, rigid cassettes approximating to the curvature of the object can be used. Where this is not possible (e.g. for welds in chains) flexible cassettes or wrapped films are used but adequate precautions must be taken to ensure good film-screen contact.

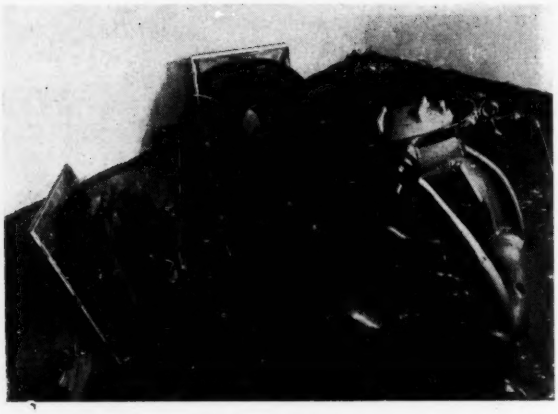
Penetrameters are pieces of metal of known dimensions and similar composition to the specimen which are usually placed on top of the specimen and adjacent to the places of interest (e.g. welds). They serve two purposes: firstly as a sensitivity gauge to measure the smallest change in thickness perceptible in the radiograph, usually expressed as a percentage thickness of the specimen; secondly as a sharpness indicator. A sensitivity of at least 2 per cent is obtainable and for some work, in particular the examination of welds, a sensitivity of better than 2 per cent is desirable.

Assembly

A large room is often set aside for gamma-ray radiography. To simplify assembly of objects to be radiographed the floor of the room is marked off in concentric circles of various diameters which correspond to the source-film distances most used. The specimens, with penetrameters and cassettes in position, are placed on the circumference of the correct circle, care being taken to ensure that the cassette is normal to the path of radiation and that the beam of radiation is directed to the middle of the section under examination. The source is then placed, or uncovered, in the centre of the circle.

The exposure time is estimated from graphs supplied with the isotope being used. One graph shows the rate of decay of the source and another gives the relation between the film density and the product of exposure time and source strength for various thicknesses of specimen, using a film of medium speed under fixed conditions of film-to-source distance. The inverse square law is applied when other film-to-source distances are used. The exposure conditions should be such that the density of the radiograph in the area under examination is not less than 2.5. Where there are wide variations in thickness of the specimen it is usual to block the thin portions or unobstructed parts with a paste of barium sulphate in vaseline so that the subject contrast is reduced. Alternatively a two-film technique is used: two films of different speeds are exposed at the same time with interleaved lead intensifying screens. The exposure time is calculated for the





Radiographs of castings: in this case mine car wheels

thickest portion of the specimen and the fastest film. The radiographs are then viewed superimposed or separately.

Interpretation and Applications

Although X- or gamma-radiography is probably the best established method of non-destructive examination for flaws, particularly in welds and castings, interpretation of radiographs calls for much judgment and experience. As in most non-destructive testing methods, great care is necessary in interpreting apparent flaws in terms of actual mechanical soundness, etc. of components. Extensive knowledge and experience of the techniques is required to differentiate in particular between internal defects and surface flaws.

Certain limitations exist in the application of gamma-radiography which must be borne in mind in interpreting the images obtained. In particular, undesirable metallographic structures cannot usually be detected and there is a limit to flaw sensitivity. Micro-cracks or inclusions, for example, which may be too small to be detected can nevertheless profoundly affect mechanical properties. Fatigue cracking also, is not revealed by radiography.

Radiographic testing has many applications, but in the coal industry is most useful in examination of iron and steel components. Porosity, inclusions, lack of fusion, incomplete penetration and cracks can all be detected. Butt-welded chains are typical examples of colliery gear which can be tested by radiography. Defects in castings, such as piping, blow holes, shrinkage cavities, slag inclusions, hot tears, etc., are all easily revealed by gamma-ray radiography.

Differentiation of the various types of defect revealed by radiography of castings is difficult and it is possible to miss defects owing to the low contrast of gamma-ray radiographs. This limitation must always be kept in mind when finally deciding on the condition of any particular casting. Absence of any indicative images of defects does not necessarily mean that the castings are sound.

Whereas X-rays can be switched off at will, gamma-ray sources emit continuous radiation. The ill effects from over exposure to radiation cannot be over emphasised. All personnel should have a blood check before engaging in gamma-radiography and checks should be repeated at regular intervals. They should also be equipped with means of measuring the actual amount of radiation received, and a log of the dosage received by each person should always be kept.

Soviet M

IN the Soviet Union the wholesale prices for all goods are established by the State Planning Authorities (sections of prices and production costs at the State Planning Committees of the Councils of Ministers of the U.S.S.R. and of the Union Republics).

In principle, the production costs serve as a basis for the establishment of the wholesale prices, but, since in a communist state "the profit is not, and cannot be, the decisive factor", the profitability of an enterprise plays a secondary rôle. It is what the state needs, social economic expediency, which dictates economic policy and the determination of prices.

In consequence, the state either subsidises heavily some branches of economy (for example the whole of heavy industry, where "the sum of prices is considerably below the sum of production costs"), or accepts the production regardless of costs (e.g. throughout the whole of the rare and non-ferrous metals industries, which are of great strategic and economic importance).

It is the latter aspect of Soviet economy that we will try to analyse in detail.

Wholesale Price Lists

In 1928, at the beginning of the Soviet planned economy period, the system of wholesale prices was based on the so-called "stable prices of 1926/27".

In 1936, during the second five year plan, these prices had to be revised, and a new system of wholesale prices was established, based on the principle of profitability. Since normal profits were secured for all enterprises, during the whole of the period 1936-1941, state subsidies were paid only to special strategically important industries.

This "balance" was destroyed as a result of the inflation which took place during World War II. In 1947 a monetary reform was therefore introduced (1 new rouble for 10 old ones), and in 1949 a new wholesale prices system was also introduced, these steps being followed closely by the introduction of the gold rouble in 1950, when new price lists were issued.

In 1955, when the party decided to give priority to heavy industries, the wholesale prices for raw materials for heavy industries were lowered (especially those for the iron and steel industry). This resulted in a new system of wholesale prices, which came into operation on July 1, 1955 and is still obligatory today.

Table I (opposite) shows how non-ferrous metals prices, compared to those of steel, have been evolving since 1928. The differences in the price scale of the Western market and that of the present Soviet system are immediately apparent.

It can be seen from Table I that only aluminium prices have been maintained in approximately the same relation to steel prices after the 1955 steel price reduction, which resulted in a considerable jump upwards in the prices of all other metals relative to steel. Despite this, the relation of aluminium-steel is still twice as big as in the West.

Metal Prices

By

JAN KOWALEWSKI

Soviet wholesale price lists cover not only finished metals, but also the prices of ores and concentrates, as well as those of the metal at various stages of its production.

A good example is afforded by the copper prices, taken from the official price lists (price lists 02-02 and 02-01; 1/7-1955, still valid, which are given in Table 2).

TABLE 2

Price in roubles per ton of metal contained in: (shown in per cent of copper)

Ores with less than 9	1950
Ores and concentrates with less than 14	3700
Concentrates with no less than 14	3900
Concentrates with no less than 20	4100
Concentrates with no less than 25	4200
Concentrates from zinc and lead plants	4300 to 4700
" Black " converter copper (90 per cent Cu)	5200
" Black " converter copper (99 per cent Cu)	6000
Electrolytic copper—cathodes	6600
Electrolytic copper—wirebars	7000

(Gold and silver contained in ores, concentrates or metal are priced separately, following separate instructions.)

The scale of wholesale prices for copper ores, concentrates, etc., has been so calculated that these prices should cover the average production costs at every stage of processing, from ore to refined metal.

There are, however, considerable differences between the production costs of individual enterprises inside a particular branch of industry. In mining and metallurgy these differences oscillate between 0.3 and 1.8 (and in some cases even more) of the average established price taken as 1.

The Soviet non-ferrous metals mining industry complains bitterly that the wholesale prices fixed for ores and concentrates are disadvantageous, while those fixed for the semi-processed or refined metals are relatively too high. In consequence the mines and ore processing plants often work at a loss, while the smelters and the refineries reap substantial profits. It appears that these scales are to be revised to give justice to the mines and ore processing plants.

Still taking copper as an example, this situation is clearly apparent from Table 3 which gives the production costs established for two copper combines in the Urals.

Comparing these production costs with the wholesale prices we see that those of a 9 per cent concentrate are 3,700-3,710 roubles, while the wholesale price of this concentrate is only 3,700 roubles, leaving the mines and ore processing plants without any profit, or even at a loss. On the other hand the production costs of converter copper are 4,318-4,345 roubles per ton of metal contained and the wholesale price 5,200 roubles, leaving about 900 roubles profit per ton.

TABLE 3

Production costs per ton of metal contained (in roubles)

		Calcinated concentrate (9.14 per cent Cu)	*Raw concentrate (8.59 per cent Cu)*
a — Ore mining		2,400	2,550
b — Ore processing		1,300	1,160
		3,700	3,710
c — Smelting	calcination	95	
	smelting in refractory furnace	382	485
	converter	141	150
		618	635
TOTAL		4,318	4,345

The wholesale price lists for other metals are similarly constructed. In the case of zinc, to take another example, they are as follows:

Price per ton of zinc contained in ores	250 roubles
Price per ton of zinc contained in concentrates from	1,000-1,500 roubles
Price per ton of zinc metal (99.94%)	3,850 roubles

Soviet Wholesale Prices Compared to West

Table 4 (overleaf) lists wholesale prices of metals in roubles and has been compiled from various Soviet sources. To compare them with the present average prices for metals on the Western market, roubles have been converted into pounds sterling at the official rate of 11.2 roubles per 1 pound sterling.

TABLE 1

Non-ferrous metals prices compared to the steel prices taken as 1

Metals	1928	1936	1949	Present-day price relation 1955	Western market
Steel (mark St-3 open hearth, rimmed, in ingots)	1.00	1.00	1.00	1.00	1.00
Copper (99.0 per cent)	9.78	16.74	9.83	15.55	7.93
Aluminium (99.0 per cent)	24.17	23.85	11.29	12.76	6.02
Zinc (99.94 per cent)	5.49	8.09	5.10	8.44	2.70
Lead (99.92 per cent)	7.42	6.92	5.88	19.17	2.40
Nickel (99.92 per cent)	39.67	70.51	58.06	64.07	20.00
Tin (refined)	—	—	—	315.00	26.17

TABLE 4

Metals	Prices per tonne in roubles	in £s	Approximative relation to the Western market prices*
Copper (wirebars)	7,000	625	2.5
Aluminium (99.0 per cent)	5,600	500	2.7
Zinc (99.94 per cent)	3,850	344	3.7
Lead (99.92 per cent)	8,600	768	10.5
Nickel (99.5 per cent)	29,000	2,588	4.2
Tin (refined)	126,000	11,250	13.5
Cast iron	400 to 500	36 to 45	2.4
Rolled steel	750 to 1,000	67 to 89	2.1
Sheet steel	1,600 to 1,900	143 to 170	4.2

* Times more than on the western market

Gold, is being sold in the U.S.S.R. internal market for technical purposes (dentistry, jewellery, spectacle frames, pen nibs, etc., at 90 roubles per gramme of pure gold contained in the alloy. This amounts to 2,580 roubles per troy ounce, or 644.5 U.S. dollars (1 U.S. dollar = 4 roubles). At the official gold price in the West (35 U.S. dollars per ounce) this makes gold in U.S.S.R. 18.4 times more expensive than in the West.

Selenium	150 rb. per klg., or	£13
Tellurium	150 „ „ „	„ £13
Cadmium	240 „ „ „	„ £21
Cobalt	268 „ „ „	„ £24
Lithium	650 „ „ „	„ £58
Zirconium	1,610 „ „ „	„ £144
Thallium	5,000 „ „ „	„ £446
Germanium	15,000 „ „ „	„ £1,340
Indium	50,000 „ „ „	„ £4,460

Beryllium concentrate	I cat.	20 rb. per klg. £1.14.0
Beryllium concentrate	II cat.	15 „ „ „ £1. 6.0
	(both 10 per cent beryllium oxide)	
Niobium concentrate	(30 per cent Niob. Ox.)	35 „ „ „ £3. 0.0
Tin oxide	(pure)	90 „ „ „ £8. 0.0

As can be seen from Table 4, the "cheapest" of the Soviet metals are still 2.5 to 4 times more expensive than those in the West, while some are considerably more expensive—e.g. lead 10.5 times; tin 13.5 times; gold 18.4 times; and indium more than 100 times.

Soviet Metal Exports

In the Soviet foreign trade statistics only Western market prices for metals are being used, these being converted in roubles at official exchange rates of 11.2 roubles per 1 pound sterling and 4 roubles per 1 U.S. dollar, both for imports and for exports.

However, since the Soviet domestic metal prices, and their production costs, are several times higher than those in the West, all metal exports from U.S.S.R. at Western market prices should result in heavy economic losses in roubles, while metal imports from the West should be extremely profitable in terms of roubles.

TABLE 5

Soviet non-ferrous metals exports in 1959 (*Official data*)

Metals	Value in rbs. (000's)	Tonnes	Export prices in rb./£/ ton	Domestic prices in rb./£/ ton
Tin	152,538	18,000	R8,363 £747	R126,000 £11,057
Lead	59,298	57,200	R1,037 £92	R8,600 £754
Zinc	68,773	73,300	R939 £83	R3,850 £337
Aluminium	154,775	77,400	R2,001 £178	R5,600 £491
Cadmium	4,361	319	R13,700 £1,224	R240,000 £21,428
Cobalt	4,007	199	R20,135 £1,798	R268 000 £23,928

To illustrate the financial consequences of exporting metals from the U.S.S.R. (see Table 5) we have chosen from the Soviet foreign trade statistics some metals whose domestic prices in roubles are precisely known.

The difference in the value of these exports calculated at domestic prices and at export prices is enormous. These six items alone are worth at export prices 443,752,000 roubles, while their value at domestic prices is 3,541,492,000 roubles!

The "loss" would, in fact, be eight times bigger than the total price of the exported goods in roubles. In other words the U.S.S.R. would pay nine times more for the foreign currency it acquired from such deals, than the official exchange rate! This economically absurd picture changes when we look into Soviet metals imports.

In the same year, 1959, the Soviet Union imported:

20,800 tons of tin, valued at 167,122,000 roubles from China;

37,300 tons of lead, valued at 38,887,000 roubles from Korea and Yugoslavia;

41,000 tons of zinc, valued at 38,919,000 roubles from Poland and Korea;

300 tons of cadmium, valued at 3,965,000 roubles from Poland.

Apart from finished non-ferrous metals, the Soviet Union imports very large quantities of ores and concentrates, for about 1,500,000,000 roubles (£134,000,000 sterling) yearly.

Since these imports are calculated at official exchange rates and at Western market prices, they go far to offset the theoretical "losses" on non-ferrous metals exports, evaluated in Table 5. Thus, in 1959, the import-export balance of the non-ferrous metals taken as one example, shows instead of the staggering loss of over 3,102,000,000 roubles, one of only 279,847,700 roubles (about £2,500,000 sterling).

This situation continues every year. For instance from 1955 to the end of 1959 the Soviet Union imported a total of 94,700 tons of tin from China (at world market prices based on official exchange rates), and exported a total of only 66,500 tons of tin, also at world market prices at official exchange rates.

In conclusion, it can be said that the Soviet non-ferrous metals exports depend greatly on its imports of these metals and of ores and concentrates, thanks to which the discrepancies between the Soviet domestic metal prices, and those of the world market, are compensated fully or in part.

As long as the Soviet non-ferrous metals production hovers around a self-sufficiency level, this state of affairs might be considered as excusable. However, if and when production exceeds domestic needs to a considerable measure (as in the case of aluminium) then export prospects would be heavily handicapped by these excessive discrepancies between domestic prices and the world market prices.

The Monetary Reform of January 1, 1961

Since the same conditions apply in a comparable degree to other important export items, such as oil, timber, grain, etc.—as well as to machinery—it seems that some radical reform must be introduced to liquidate or at least moderate this economic paradox presented by the difference between Soviet domestic prices and the Western market prices.

This might be accomplished by the coming monetary reform announced in June 1960, which is to be introduced on January 1, 1961.

TABLE 6

	METALS (all prices per 1 metric ton)	Prices in roubles: present roubles	Prices in roubles: new roubles (10 : 1)	Prices in pound sterling: at the present exchange rate £1=11.2rb.	Prices in pound sterling: at the supposed new exchange rate $1=2.8rb.	1959 Western metal market prices in £s	Relation between the Soviet prices and the Western market prices: at present	Relation between the Soviet prices and the Western market prices: after the supposed roubles reform	
Ferrous Metals	Cast iron	400 - 500	40 - 50	36 - 45	15 - 18	17 - 18	2.4	**1.0**	**Iron, steel, copper, aluminium, zinc and nickel are on the level of the Western market prices**
Ferrous Metals	Rolled steel	750 - 1,000	75 - 100	67 - 89	27 - 36	26 - 43	2.1	**1.0**	
Ferrous Metals	Sheet steel	1,600 - 1,900	160 - 190	143 - 170	57 - 68	33 - 40	4.2	**1.7**	
Non-Ferrous Metals	Copper	7,000	700	625	250	209. 7.6 251. 5.0	2.5	**1.0**	
Non-Ferrous Metals	Aluminium	5,600	560	500	200	165. 0.0 186. 0.0 217. 0.0	2.7	**1.1**	
Non-Ferrous Metals	Zinc	3,850	385	344	137	70.13.9 93. 2.6	3.7	**1.5**	
Non-Ferrous Metals	Nickel	29,000	2,900	2,588	1,037	600. 0.0	4.2	**1.75**	
Non-Ferrous Metals	Lead	8,600	860	768	307	68. 7.5 74.10.0	10.5	4.2	Lead, tin and gold still remain much more expensive than in the West, but the difference is much less disadvantageous than at present
Non-Ferrous Metals	Tin	126,000	12,600	11,250	4,500	747. 5.0 802.15.0	14.0	5.4	
				In U.S.A. dollars					
	GOLD (per oz.)	2,580	258	$644.5 $1 = 4rb.	$258 $1 = 1rb.	$35	18.4	7.4	

As in the anti-inflationary reform of 1947, the new rouble will be worth 10 old roubles, and all domestic prices and wages will also be reduced tenfold. In this way nothing will change, apart from the number of zeros, prices and wages. At the same time, however, the exchange value of the Soviet rouble as well as its gold content, will also be increased.

So far none of the Soviet authorities have committed themselves to stating whether the rouble exchange rate will be also increased ten times . . . or less. This reticence could in itself be interpreted as an indication that the rouble exchange rate will be increased *less* than ten times.

There are vague indications that the planned change of the rouble exchange rate will be its fourfold increase, thereby putting its gold content on a par with that of the U.S. dollar. This would mean that in respect of the domestic rouble, the gold rouble and its exchange value would be *depreciated* 2.5 times.

If these assumptions are true, then the entire financial aspect of Soviet export possibilities will be radically improved.

Table 6 shows what would happen to the export prices of Soviet metals :

This table is based on the assumption that, while the domestic rouble will be increased in value ten times, the external rouble will be increased in value only four times, its exchange rate being elevated from 11.2 roubles per pound and 4 roubles per dollar to 2.8 roubles per pound and 1 rouble per dollar.

As yet no official statement is available, but we consider it most important to attract Western attention to the possibility of such a reconstruction of the values of the rouble, in view of its effects on the potentialities of Soviet foreign trade.

The final answer to this problem will be given on January 1, 1961, when the announced rouble reform will be introduced.

£323,000 More for African Education

The Rhodesian Selection Trust Group of Companies and the copper mining companies administered by the Anglo American Corporation are to make available a further sum of £323,000 for African education in urban areas of Northern Rhodesia.

Last March the two mining groups announced that they would make available £1,300,000 towards the cost of additional facilities for African education on the Copperbelt. By arrangement with the Northern Rhodesia Government, this sum which was to be half in the form of donations and half in the form of low-interest loans, was to be devoted to the capital cost of providing six years of primary education for those African children on the Copperbelt reaching the age of eight for whom no places would otherwise be available. The plan also provided for further primary and secondary schooling for a proportion of these children, and for the training of teachers.

The new sum of £323,000 which will be made available on the same terms as the original £1,300,000 (donations, loans), is to be devoted to three main purposes—first, to extend the planned junior secondary school at Kitwe to include provision for senior secondary education, secondly, to provide addition primary school facilities at Broken Hill, and thirdly, to establish facilities for secondary education at Broken Hill.

Plans for the teacher-training college in the Copperbelt, provided for in the original scheme, will also be extended to allow extra teachers to be trained for the additional primary school facilities at Broken Hill.

Production and Uses of Arsenic

ARSENIC is a widespread though not abundant element and its most extensive minerological occurrence is associated with copper, lead, cobalt, nickel, iron and silver, alone or with sulphur.

Arsenious oxide, otherwise known as white arsenic, or arsenic trioxide (As_2O_3), is the chief source from which other arsenic compounds and arsenic metal are derived. It is produced principally as a by-product of copper and lead smelting and in the recovery of other metals, notably gold and silver. The arsenic content of the treated ores is often small.

Arsenic is used principally for manufacturing calcium and lead arsenate insecticides, but the use of arsenicals as pesticides has declined since the introduction of organic compounds during World War II. Other important uses are in wood preservatives, lead shot, glass manufacture and weed control.

Though white arsenic is produced in more than 22 different countries, only four of these have a decisive influence on world output. These are Sweden, the United States, Mexico and France. Average world production in 1948-52 was 55,000 s.tons, but this had fallen to 39,000 s.tons in 1958, recovering to 47,000 s.tons in 1959.

Of the total 1959 output, Sweden produced 12,787 s.tons, the entire output coming from the Boliden Mining Co., which continued to be the world's leading producer. Mexico produced 11,533 s.tons (the highest figure since 1951); France 9,040 s.tons; and U.S. 5,189 s.tons. Production in the U.S. was the lowest since 1914, principally because of strikes in the copper producing industry. The entire output was a by-product of smelting complex copper and lead ores by the Anaconda Co., the United States Smelting, Refining and Mining Co. and the American Smelting and Refining Co. In Canada, all the output of refined arsenic trioxide is supplied by Deloro Smelting and Refining Co. Ltd. from smelting silver-cobalt concentrate from the Cobalt and Gowganda areas in northern Ontario.

In Southern Rhodesia arsenic is recovered as a by-product in roasting arsenical-gold concentrates at the government roasting plant, Que Que. The production is consumed locally by African Explosives and Industries. In 1959, 528 s.tons were produced.

Recovery of by-product white arsenic usually exceeds demand and is unresponsive to price. The London price for 98-100 per cent white arsenic throughout 1959 was £40-£45 per l.ton (5.00-5.63 c. per lb.). For arsenic metal the price was £400 per l.ton (50.00 c. per lb.).

No ores are now mined in the U.S. directly for arsenic nor has elemental arsenic been produced in recent years.

Metallurgy

The metallurgy of arsenic is concerned chiefly with the treatment of arsenic-bearing flue dusts from smelting plants which can carry as much as 30 per cent arsenic trioxide. The flue dust is mixed with a small quantity of pyrite or galena to prevent the formation of an arsenite, and roasted in a reverberatory furnace. The clinkering residue produced can be returned to the process for the recovery of other metals while the gases containing the volatilized arsenious oxide are cooled by passing them through a series of chambers with temperatures reducing from 220 deg. C. to 100 deg. C. The condensed crude white arsenic is collected in cooling flues, baghouses or Cottrell precipitators. Should higher purity be required the treatment is repeated. A product assaying 99 per cent or more arsenic trioxide can be produced, if necessary. Because of the increased demand for high-purity arsenic in semi-conductor compounds and low-melting glasses, the capacity for producing this has increased. Metallic arsenic is prepared by reducing white arsenic with charcoal.

High-purity arsenic containing 1.1×10^{-9} atomic fraction of sulphur, 2×10^{-8} of selenium and 2×10^{-8} of tellurium has also been produced by an improved distillation technique whereby one part by weight of purified arsenic was heated with two parts of lead at 600 deg. C. in an evacuated chamber. The vaporized arsenic was then condensed, leaving most of the impurities in the lead.

No useful data is available on world reserves of arsenic, but there are two inactive mines in the U.S. near Gold Hill, Utah, belonging to the United States Smelting, Refining and Mining Co. and the Western Utah Copper Co., which have yielded arsenic in the past and still hold substantial arsenic reserves. Other mines that could yield arsenic directly in connection with the milling or treating of ores for valuable metals could also be operated, if need be. The total U.S. reserves of recoverable white arsenic are put at 2,500,000 tons, including the by-product of smelting operations (1,000,000 tons), milling gold and silver ores (1,000,000 tons) and high-grade 20 per cent As_2O_3 ore (500,000 tons).

New Uses

A number of new uses for arsenic have recently been reported. Asarco conducts an intensive research programme for the development of arsenicals and has recently announced new arsenic compounds known as arsonosiloxanes with the water-repellent properties of silicones and improved pesticides. Research at the Battelle Memorial Institute has included the arsenic coating of steel, brass, copper, nickel and other metals. Arsenic compounds are also used for hide-tanning and the manufacture of paint pigments. A newer method of killing and debarking trees with sodium arsenate is used under certain conditions. Ultrapure arsenic is used in producing high-purity gallium arsenide and indium arsenide which may be useful in transistors. Another use of arsenic is in the semi-conductor industry. In this connection, arsenic has been combined with silver to form an alloy with a melting point of 1,800 deg. F., which is well above the usual 1,200 deg. F. range of alloy junction materials. Containing 99 per cent silver and 1 per cent arsenic, the alloy was produced in spheres of from 0.001 to 0.125 in. in dia.

The world consumption of arsenic is not expected to change appreciably in the immediate future and world output is likely to remain around the 1955-58 level. Looking further ahead, production in Sweden may fall as a result of the accelerated depletion of mineable by-product arsenic. In the U.S., the recovery of white arsenic will vary with changes in the production of copper and lead to which it is inherently tied. Consumption of arsenic in the U.S. reached an all-time high during 1959 and the American Smelting and Refining Co. claim to have a ready and growing domestic market.

Technical Briefs

Treatment of Beryllium Ores

The growing interest in beryllium, has sparked off some work in recovery processes, but in general, any one unit process has not proved satisfactory. Flotation often yields a low-grade concentrate with rather poor recovery and usually combinations of hand sorting, gravity and flotation appear to be most satisfactory.

The flotation operation often involves separating mica by means of an amine and an acid circuit and then producing a mixed beryl - iron - felspar concentrate after activation with hydrofluoric acid. This mixed concentrate is then treated by hypochlorite to destroy the amine when the beryl and iron minerals can be floated by means of a petroleum sulphate. Some beryllium is soluble in sulphuric acid and in August last a joint announcement by Brush Beryllium Co. and Beryllium Resources Inc., claimed "a break-through" in the treatment of ores from the Topaz Mountain district of Utah. The process is said to involve several hydrometallurgical steps finally producing beryllium hydroxide.

Discoveries in the Topaz Mountains were reported in our issue of September 30, page 362.

IRON MAKING PROCESS

A stage of commercial interest in new areas has been reached in the development of the Dwight-Lloyd McWain process for making iron, it has been reported in a paper presented before the Iron and Steel Division of The Metallurgical Society of the American Institute of Mining, Metallurgical, and Petroleum Engineers.

The authors, T. E. Ban of Cleveland, Ohio, vice-president of McDowell Co., Inc., and B. W. Worthington, of Birmingham, Alabama, director of research of McWane Cast Iron Pipe Co., said, in summary:

"Highly beneficiated feed from the D-LW process is produced from low rank raw materials by use of well-proven metallurgical equipment. Hot, carbonized pellets are smelted in a conventional submerged arc furnace instead of the usual self-fluxing sinter-coke burden and electrical energy requirements are diminished more than fifty per cent, while furnace productivities are more than doubled."

The paper said, in part:

"The process represents a development advanced to a stage for commercial consideration. Many interesting avenues of future developments are being researched at the Dwight-Lloyd Research laboratories. Some of the approaches under current development include; use of various blends of coal and additives for improving the chemical and physical quality of carbonized pellets; use of preheated and reducing gases for carbonization; use of coarse flux within the carbonizing bed rather than the disbursed flux within the pellets. This method of iron making involves the use of well-proven metallurgical equipment and opens commercial interest in regions heretofore considered marginal for conventional and electric furnace smelting."

The process consists of the continuous smelting of carbonized pellets produced from ore, flux, and coal. Sequential phases of production include blending, grinding, balling, carbonizing, and smelting. Direct shipping iron ores and concentrates are used as the source of metallic charge, and slack varieties of non-coking coals are used as the reluctant.

NEW DRYERS

As the result of nearly two years of intensive research and development the dryer department of AEI-Birlec now introduce a new series of adsorbers—the BZ series Autosorbers.

The new designs are fully automatic, dual tower plants, suitable for the continuous drying of compressed air and other gases. They have been arranged to be capable of using any of the commercially available adsorbents—activated alumina, molecular sieves, silica gel, Sorbead—and to employ them effectively to their best capacity according to the required circumstances.

A further feature of the new plants, which derives from their ability to operate with molecular sieves, is their utility for the adsorption of carbon dioxide. Typical figures are in the range of 25-500 s.c.f.m. at 100 p.s.i.g. or 5-100 s.c.f.m. at atmospheric pressure. Extensive experimental work on process capacity and pressure drop under a range of flow conditions underlies the final designs now in production.

Arising from the fundamental approach to dryer design and the exploitation of a laboratory budget of £10,000 devoted to research and development, 8 applications have been made for patent cover. These applications include new methods of heating and cooling the adsorbers during the reactivation period and new methods of economizing in the flow of purge gas.

FERRONICKEL BY THE UGINE PROCESS

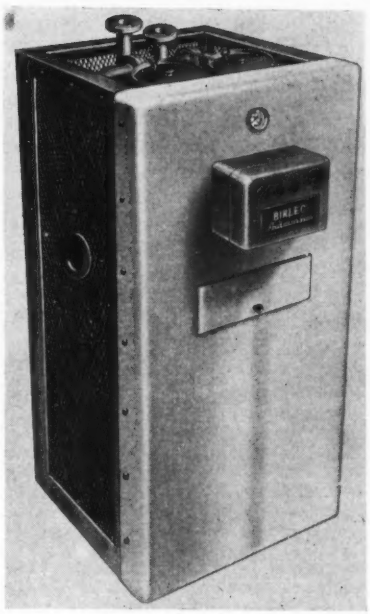
The operation of the Hanna Nickel Smelting Co. at Riddle, United States, has overcome most of its problems and the smelter is reported as producing ferronickel at a rate nearly 25 per cent above design capacity.

The smelter uses the Ugine process which has proved satisfactory and economical. It is said to be the first time the process has been used for large scale, continuous operation.

This technique, it has been stated officially, "involves the addition of a suitable reducing agent to a mixture of molten oxide ore in the presence of molten ferrous metal, using violent agitation for mixing the reducing agent and molten metals." The exothermic heat of the reaction assists in maintaining high temperature during the reduction cycle. The process is said to be particularly adaptable to lateritic type, low-grade nickel ores of high magnesia content and is especially attractive in an area where low cost electrical power makes electric furnace melting economical.

In the Riddle adaptation of the Ugine process, silicon is used as a reducing medium, added in the form of 45 per cent ferro-silicon. Agitation of the reducing medium and molten ore is accomplished by pouring material rapidly from ladle to ladle.

The open pit mine is on Nickel Mountain, some four miles north-west of Riddle. The mine is at an elevation of 3,000 to 3,500 ft. above sea level, some 60 miles from the Pacific and about 60 miles north of the California line. The nickel mineral is garnierite, a complex magnesium silicate of nickel (H_2 (Ni, Mg.) SiO_4 + H_2O) associated with iron, cobalt, chromium, and aluminum. Mineralization consists of finely divided veinlets. The orebody is roughly 3,000 ft. by 6,000 ft. with an average depth of about 60 ft. The ore grade is approximately 1.5 per cent nickel.



The AEI-Birlec series BZ Autosorber

AUTOGENOUS GRINDING BY BOLIDEN

Autogenous grinding by the Boliden Mining Co. has been introduced ahead of flotation at the company's new lead mining property at Vassbo, Sweden.

Using a 22 ft. by 7 ft. Hardings cascade mill the ore is ground so that 80 per cent is −80 microns. The ore is said to be most abrasive.

Machinery and Equipment

Rational Materials Weighing

During recent years the art of weighing has become more and more refined, with higher precision and also the possibilities of using the weighing results through electronic data handling. Conventional beam balances are provided with equipment for transforming balance reading to electronic data. This method is, however, expensive and it is necessary to use a lot of ancillary equipment.

There has long been a demand for an electronic balance that will give the weighing result direct in such a form that it can be used for further handling. Partial solutions for special applications have been forwarded but hitherto it has not been possible to establish a general weighing system.

The Elestat system, designed by The Elenik Engineering Co., Sweden, is stated to provide a rational solution. The equipment developed consists of a number of standard units that can be combined simply to solve the most different types of weighing.

The Elestat system can also be used for earlier unsolved problems as for example automatic weighing in travelling cranes and other types of cranes, weighing of digesters, of ladles and of electrosteel furnaces. As weighing is accomplished rapidly it is possible to weigh slowly moving railway cars. The system is also convenient in those industries where it is necessary to weigh at different points in the process.

It is important that the units in the Elestat system can be used separately and that later new units can be added to form a complete system for several weighing points. It is possible to start with one equipment for one weighing point and later add units for more weighing points to the central instrument. Equipment for automatic recording can be added later for batching, etc.

The Elestat weighing system AG-10 consists of one central equipment to which the different weighing points 1, 2, 3, etc. are connected. To this central equipment an equipment for recording is then connected, for example punch card equipment or an adding machine with electromagnetic input. The central equipment is normally the instrument CG-1003 with a dial indicating the weight. If many weighing points are to be connected, a switching unit is added to the central equipment and will connect one weighing point after the other to the central equipment.

If it be necessary to read the weight at the weighing point, a special control unit is used. All adjustment of the equipment at the weighing point is made with this unit and on its dial the weights are read with the same accuracy as on the central equipment. In some cases it is convenient to read the weight in digital form. In those cases a digital unit GK-2002 is connected to the central equipment. This will convert the readings on the central equipment to corresponding digital values. These digitals can be either on the digital unit, on the control unit, or also as separate big digits made of a number of glowlamps.

For recording, a special code unit is used which converts the digits to special signals to be fed to the adding machine or to the punch card equipment. Through this unit special references are recorded also, such as the date, number etc., which can be added manually with the use of a special keyboard. The different values can be recorded either on different adding machines, one for each balance, or on one common adding machine. In some cases it is desired that one weight be kept constant or one batch is to be processed in sequence to another of predetermined weight. In those cases a special unit is connected to the control unit. For this purpose also a special servoregulator and other control equipment can be used.

Elenik manufactures a range of load cells for different applications, the smallest one for 220 lbs. is used in conveyors and for smaller static balances, the biggest 150,000 lbs, is used for weighing of digesters.

The load cells developed by Elenik Engineering Co., are based on metal foil strain gauges, which have a power sensitivity which is about 100 times greater than that obtainable with wire strain gauges. The load sensitive elements are placed in hermetically sealed cylinders with diaphragms conveying the load. Such load cells are used in weigh bridges, where they are placed under the four corners. For bigger loads they are brought together in groups and placed in a box made in such a way that only the load to be measured will be transformed to the load cells. By this method load cells are combined to measure many hundred thousand lbs.

The load cells are made in two classes of accuracy, class N with an accuracy of ± 0.25 per cent and class X with an accuracy of ± 0.1 per cent. The accuracy obtainable for the whole weighing system depends generally on how the load cells are built in and can, therefore, only be stated when all such details are known.

An example of the use of the load cell box is its employment for weighing in band conveyors. In this application the load cell is placed in a box and one roller section is taken off the conveyor and placed on the circular plate on top of the box. This box is then put into the conveyor at the same place as the roller section normally was placed.

One control unit can be used at each weighing point for operation of the central equipment and for reading. The control unit FG-1003 contains (1) controls connecting the weighing point to the central equipment and for taring and adjusting of the balance; (2) stabilizing power unit for the load cells; and (3) dial indicating the weight. If the central equipment has a digital unit and adding machine connected, a control unit FG-1004 is used, which has also (4) a keyboard, type FG-3001, with which reference numbers etc. are recorded.

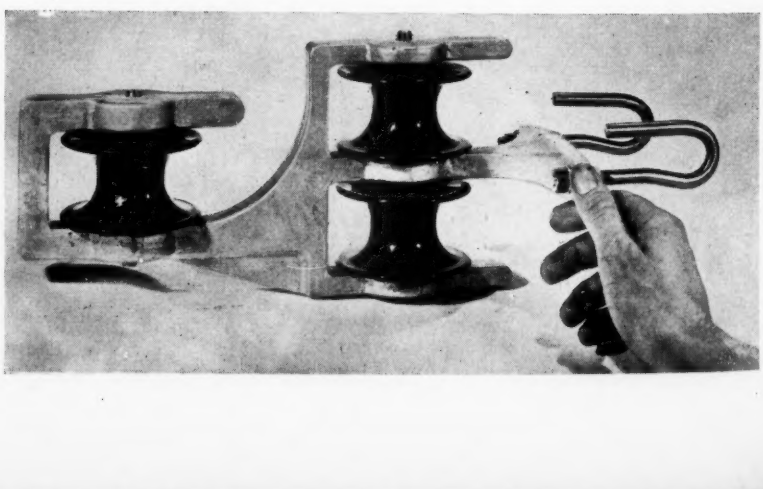
In so far as the electronic scale is concerned, the instrument CG-1003 is in principle a self-balancing compensator with a dial indicating the remainder after balance. The self-balancing compensator bridge consists of one stepping relay with goldplated contacts with which the bridge is balanced in steps. The remainder, after this balancing, is fed to an amplifier with heavy feedback and is indicated on a dial. Simultaneously to the balancing the figures on the dial are changed.

The dial has a scale length of 19 ins. for each decade, i.e. 100 in. totally with 1,000 divisions, which will give a reading accuracy of 0.1 per cent. The instrument is made for 110-220 v 50 c/s.

In many cases it is convenient to have the weight in digits. In such a case a digital unit, GK-2002, is connected to the instrument mentioned above. This digital unit will give the weight to three or four figures.

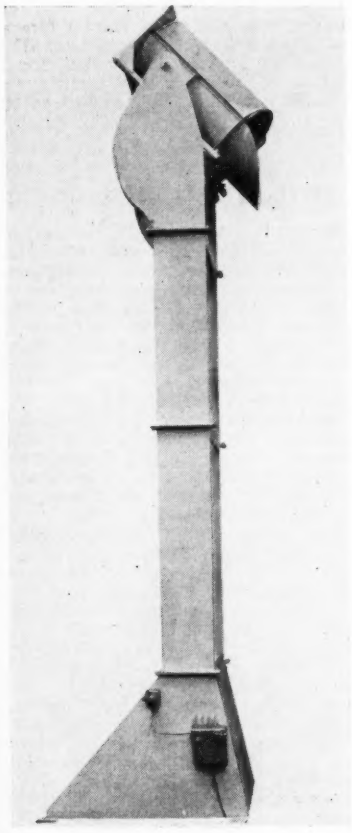
The simplest recorder is a normal adding machine equipped with electromagnets which press down keys on the

Faster and more economical installation of power distribution cables is possible with Plaskon nylon pulley block according to Allied Chemical International, United States. The nylon pulley is characterized by high tensile and impact strength. Made by Hendrix Wire and Cable Corp., U.S., the block is designed to facilitate the installation of an aerial cable. The company manufactures a complete line of highly adaptable cables for use on power distribution systems, which minimize the need for shielding and insulation



keyboard. Reference numbers are recorded without being totalled by use of the non-add button. The coding unit will convert the digital unit figures to suitable pulses, which are used to operate the keys in the adding machine or for operation of the card puncher. The coding unit will also convert reference values manually recorded with the keys on the control unit, so that they can be recorded on the adding machine or on a card puncher.

In many cases a certain weight must be kept constant, or batch after batch must be weighed automatically. In this case the control unit FG-1003 is used with a special unit FG-2002, which consists of one circuit, which will compare the actual weight with a preset value. Any difference will, at regulated control, be fed to a servo unit or a relay, which will be actuated and stop feeding of the material at a preset weight. Presetting the value of a batch, the weighing



instrument itself is used as a reference, and will indicate how the material is fed down and when the preset weight has been reached, the instrument will automatically switch over and show the whole weight.

FOAM CONTROL OF MINE FIRES

A progress report on U.S. Bureau of Mines research in using high-expansion foam to control underground mine fires has been released by the U.S. Department of the Interior. The technique, developed originally in the United Kingdom, involves the use of chemicals to create the foam which is pushed toward the site of the fire by the mine's ventilating current. The Bureau's studies at its experimental coal mine, near Pittsburgh, Pa., have covered various kinds of foam-making chemicals and foam-making equipment as well as different types of fires.

According to the Bureau, foam must contain at least two-tenths of an ounce of water per cu. ft. of foam to be effective. Some of the fires were extinguished outright, but the studies revealed that in many instances the foam's chief effect was a cooling influence that permitted experimenters to enter the fire zone and make direct and final attack with water or other extinguishing agent or load the hot material into cars for removal from the mine.

A copy of the publication, Report of Investigations 5632, *Controlling Mine Fires With High-Expansion Foam* can be obtained from the Publications-Distribution Section, Bureau of Mines, 4800 Forbes Ave., Pittsburgh 13, Pa.

Above is the Case 1000 shovel with hydraulic ripper on the floor of a limestone quarry. Below and at left, on this page, the Hi-Tip lifting and tipping machine

A TRACTOR RANGE

Since January 1960 J. I. Case Co. Ltd., in the United Kingdom, subsidiary of J. I. Case Co., United States have been growing in the industrial wheeled and crawler tractor field.

The Case crawler range currently offered in the United Kingdom includes the Case 800 shovel (20,700 lbs. drawbar pull—1½ cu. yd. standard bucket capacity); the 1000 shovel (25,400 lbs. drawbar pull—2 cu. yd. standard bucket capacity); and the Case 1000 hydraulically angling or tilting 'dozers. These machines are distinguished by their system of terramatic drive, a fusion of torque converter and constant mesh gear train which gives independent control to each track. Thus immediate changes of speed or direction are made possible " on the go ", and a high degree of manoeuvrability is achieved. The advantages are obvious when working in confined spaces such as pits or quarries.

The range of wheeled loaders comprises loading shovels from 1 to 2½ cu. yd. standard bucket capacities and horse powers from 57 to 120. All these are also equipped with torque converter, power shuttle transmission and power steering. They are designed to combine long forward reach with the high degree of stability necessary when carrying heavy loads at the high speeds at which they operate.

LIFTING AND TIPPING MACHINE

To meet the need for a simple and reliable machine for lifting and emptying all types of containers, Russell Constructions Ltd., have developed a unit which will lift any kind of container weighing up to 10 cwt. and will tip it so as to empty the contents into a hopper, truck, mixer or other receptacle. This machine, known as the Hi-Tip, has a minimum height of lift of 4 ft. 6 in. An interesting feature is the fact that vertical sections can be added to increase this dimension to any height desired.

The machine is fabricated of ¼ in. mild steel of all-welded construction and consists of a base, a top unit and centre sections. The base, which for the standard machine occupies an area of only 3 ft. by 4 ft. 6 in., houses the electrical equipment, control mechanism, main drive and chain compensating device all the mechanical parts being adequately protected.

The start and return operations are actuated manually but automatic sequence control can be provided if required, the emptying time being controlled by a variable time switch. The speed of lift is 30 f.p.m. and the standard tipping angle is 30 deg. from the vertical. The cradle can be adapted to take any particular type of containers, the chute being shaped to suit the material being handled.

The Russell Hi-Tip is suitable for continuous 24 hour operation.

MINING MISCELLANY

Barclays Bank D.C.O. reports from Ghana that a West German gold mining company, the Herbert Reichel Mining Corporation, is said to have signed concessional agreements with paramount chiefs in the Adansi Banka and Bekwai States. The company plans to start mining within two years.

★

Three 42 in. primary gyratory crushers are being supplied by the German firm, Wedag of Bochum, for an underground installation on the Rhodesian Copperbelt.

★

U.S. bituminous coal production this year will total 420,000,000 tons, an increase of 8,000,000 tons above last year, according to a forecast by the National Coal Association in Washington, but the national level is expected to rise only 3,000,000 tons next year. The group's Market Forecast Committee predicted that electricity services, which are the biggest buyers of coal, will use 175,000,000 tons in 1960 and 185,000,000 in 1961. Coking coal, principally for the steel industry, is expected to account for 84,000,000 tons in 1960 and 83,000,000 in 1961.

★

National Carbon Co., Division of Union Carbide Corporation, has produced a single piece of graphite 30 ft. long, measuring 12 by 14 ins. on its sides. The column weights 3,700 lb.

★

Indonesia is planning to set up a steel works with an annual capacity of 100,000 tonnes, in Kalimantan, to be financed by part of the $250,000,000 Soviet credit to Indonesia.

★

Negotiations are reported to be taking place for the amalgamation of the Lota and Schwager coal mines at Concepcion, Chile, in order to secure their more economic operation.

★

The Eastern Nigeria Ministry of Commerce has entered into an agreement with a foreign industrialist to start an iron and steel rolling mill industry in Enugu, using local coal. A new factory for the production of aluminium products is in course of erection in the area.

★

It is reported from Thailand that a Japanese company, the Asia Mining Co., is exploiting feldspar deposits in the Chiengmai area of North Thailand for export to Japan.

★

Exploration of pyrochlore deposits and preparation for exploitation of known reserves is being carried out north of Lake Kivu in the Congo Republic by Somilu, a newly-formed joint subsidiary of Compagnie Minière des Grands Lacs Africains and the U.S company, Union Carbide. The former company has rights to the considerable deposits, while Union Carbide is providing financial backing and experience in the niobium field.

Oil production in Albania has increased 3.3 times since 1955, coal five times, and chrome ore 2.4 times. A number of new mineral deposits have been located and ten of these are now being exploited, including seven regarded as being of major importance.

★

A 19,100 tons deadweight bulk ore carrier, the s.s. "Iron Dampier" has been launched at the Broken Hill Proprietary Co.'s Whyala shipyard. This ship, like the sister ship commissioned in August, 1959, was designed to carry iron ore from Yampi Sound to Port Kembla.

★

The Fire Research Station, at the Department of Scientific and Industrial Research, Boreham Wood, has been carrying out tests on the fire resistance of vermiculite plasters.

★

The British section of the International Association for the Exchange of Students for Technical Experience (IAESTE) in their annual report announce that 908 students came to Britain and 883 were sent abroad during the summer vacation of 1960, an increase on the 1959 figures. Of students taking courses in metallurgy, mineral dressing, mining and mining geology 103 went abroad to work at foreign firms during this period, and 49 came to Britain.

★

For the first time since 1910, the Iron and Steel Institute of Great Britain will hold a meeting in the U.S. in 1961. Hosts will be the Metallurgical Society of the American Institute of Mining, Metallurgical, and Petroleum Engineers, and the American Society for Metals. Some members of the British party, due to arrive in New York on October 17, 1961, will be attending the Annual Metal Congress, to be held in Detroit from October 23. The British organization planned to meet in the U.S. in 1938, but the threat of war caused a cancellation of the plan.

★

Ambassador Irish Oil, which is an Irish-registered subsidiary of an American oil company, will start deep drilling for oil and natural gas in the Central Plain of Ireland within the next 18 months. The company, which holds exclusive oil exploration rights from the Irish Government, states that geological maps show that the rocks of this area are mainly limestone of the carboniferous age. The survey will extend eastwards from Longford to Dundalk, southwards as far as Dublin, and westwards towards the Bog of Allen.

★

A three-mile tunnel, 6,000 ft. above sea level, connecting the U.S.S.R.'s largest fluorite deposit at Naugarzan with the Angren-Almalyk mining district of Uzbekistan, has been cut through the Kuramin mountain ridge in western Tien Shan. This is expected to enable Uzbekistan to double its fluorite production.

Three very large deposits of pumiceous material are reported to have been found on islands of the Lesser Antilles, West Indies. The deposits are situated on Dominica, Martinque and St. Eustatius. Other less promising deposits of pumice, pumicite, volcanic cinders and pozzolanic earths are known to exist in the West Indies. Copies of the report "Pumice and Pozzolan Deposits in the Lesser Antilles" by Edwin B. Eckel are available for reference at the folowing offices: U.S. Operations Mission, Port of Spain, Trinidad; and U.S. Geological Survey Library, 1033 General Services Administration Building, Washington, D.C.

★

The Tasmanian Electro-Metallurgical Co. (Temco), subsidiary of the Broken Hill Proprietary Co., expects that the plant now being erected at Bell Bay, Tasmania, at a cost of £A.1,500,000, should be completed within 18 months. The plant, initially to operate with one furnace, will include an electric furace, crushing and conveying equipment. The works will produce high carbon ferromanganese for use in steel manufacture at the Broken Hill Co.'s mainland works.

DEVELOPMENT AT ALLIHIES

Mr. J. D. McCannell, president of Trans-Ocean Exploration and Management Ltd., reports that the development programme currently being undertaken by Can-Erin Ltd., at the Mountain Mine Allihies, County Cork, Ireland, utilizing three diamond drills, should be completed early in 1961, and is designed to prove ore reserves of at least 5,000,000 tons. Achievement of this goal will enable finalizing plans for sinking a new production shaft to the 3,000 ft. level in preparation for bringing the Mountain Mine into production at an initial rate of 1,500 tons per day, which such ore reserves would justify.

The drilling which Can-Erin Mines Ltd. completed to date on various underground levels of the Mountain Mine (one of five formerly producing mines in close proximity on the company's extensive holdings at Allihies) has already proved a total of 2,350,000 tons that should mine at approximately a 2 per cent average copper grade. The three diamond drills presently working in the mine are rapidly proving additional tonnages of ore in the four known ore zones—the North-South, the New East-West, the main East-West and the recently discovered No. 2 East-West. The latter promises to be particularly important in adding to the ore reserves.

Before the end of this year, it is also planned to make the first test of the nearby Caminches Mine, by means of a flat diamond drill hole 1,200 to 1,500 ft. in length drilled to the South-East from the 1,350 ft. level of the Mountain Mine. The Caminches mine produced copper from an orebody developed along a strike length of 600 to 700 ft. and to a depth of 900 ft. This mine was closed some time during the 1870's. The flat diamond drill hole from the Mountain Mine is planned to cut the Caminches ore zone below the existing workings to prove the downward extension of this ore zone similar to the underground exploration carried out in the Mountain Mine.

Metals and Minerals

Aluminium and Steel in American Motor Cars

The annual survey by Kaiser Aluminium and Chemical Co. indicates that U.S. car makers will require 15 per cent more aluminium than a year ago for their 1961 models, involving a net consumption of at least 190,000 tons for the 1961 model year. The introduction of four more aluminium engines in 1961 model cars, it was stated, pointed to an average requirement of 62.1 lb. per car, based on a six-million new car year. Actual net usage per car for the 1960 model year was 54.4 lb. per vehicle.

The compact car, which was a major cause of a reduction of about three lb. per car in anticipated aluminium usage (in the 1960 model year), is expected to increase average unit use this year by 7.7 lb. and possibly more. This is because the compacts are likely to continue to dominating the new car market and may possibly gain an even bigger share of total sales. A development of considerable significance to aluminium producers is the reported increase in demand for the small car with automatic drive, which is a major user of aluminium for housings.

Cars with the new aluminium engines will lead all models in aluminium usage, states the Kaiser survey, ranging from 106 to 135 lb. per unit. Chevrolet's Corvair was the only 1960 model to use an aluminium engine, resulting in a total aluminium use of 106.9 lb. per car. Oldsmobile's new F-85 will require 134.9 lb. of aluminium, including the metal in the V-8 engine block. The complete engine weighs 325 lb. as against nearly 600 lb. had the block been made of cast iron. The new Buick Special, which will be equipped with a V-8 engine block similar to that of the Oldsmobile will require 132.6 lb. of aluminium as compared with 70.3 lb. for the regular 1961 average Buick. The American Motors Rambler will be equipped with a die-cast six-cylinder engine block with cast iron liners. It reduces engine weight by some 80 lb. from last year and at the same time nearly doubles aluminium use from 62 lb. to 120.6 lb. Chrysler will later introduce a six-cylinder aluminium engine, which, it is reported, will be installed in about 10 per cent of its smaller cars on a test basis. This will reduce engine weight by about 200 lb. from that of a similar unit in cast iron.

According to "Steelways", the standard 1959 models of U.S. motor cars used an average of 3,600 lb. of steel per car or 91 per cent of total weight, but the average 1960 compact car uses about 800 lb. less. Here the increasing share of the American market being captured by the smaller cars must be a matter of some concern to steel producers. The success of the compacts would appear, in fact, to be among the factors which have contributed to the failure of U.S. steel demand to measure up to earlier expectations.

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The buoyancy of the demand for aluminium in the U.K. is indicated by the results of the British Aluminium Co. Ltd. for the twelve months ended July 31, 1960. In his annual statement to shareholders the chairman, Lord Plowden, was able to report that sales during the year established a record by a substantial margin, reflecting increased activity in many markets. The profits earned by the company also exceeded by an appreciable amount those earned in any previous year. Increased rainfall permitted an appreciably larger production of metal at the reduction works in Scotland than had been possible in the last two or three years. This was reflected back to the company's mining and alumina production operations, which have all made a worthwhile contribution to trading results. The output of fabricated products from the rolling mills and extrusion plants established a new record well above anything previously attained and the higher loading of the plants has been beneficial to costs.

It was in January, 1959, that the Reynolds-Tube Investments combination acquired a controlling interest in British Aluminium. Arrangements for the integration of the manufacturing facilities of British Aluminium and of Reynolds T. I. Aluminium Ltd. have been completed and since the beginning of August this year the facilities of the two companies have been operated as virtually one group. It is anticipated that in the relatively near future the assets of Reynolds T. I. Aluminium will be merged formally into British Aluminium. During the year, considerable reorganization of the management of the company and of its group interests has been carried out and great benefit has been derived in sales organization, production technique and financial control from close collaboration with the two major stockholders.

The company anticipates that demand for aluminium, particularly in the U.K., will increase substantially during the next five to ten years. As is to be expected, however, now that all three major U.S. producers have links with British firms, conditions are becoming increasingly competitive and keen selling and marketing will be required. British Aluminium is determined that its facilities for the manufacture of fabricated products will remain in the forefront as regards efficiency, capacity and range of products. Considerable expenditure has already been authorized to this end and further proposals are under review. Steps have also been taken to ensure supplies of metal to meet increasing manufacturing requirements.

As previously noted in this journal, the company will be assuming the rights and obligations previously vested in the Commonwealth Aluminium Corporation to the large bauxite deposits at Gove in the Northern Territory of Australia. It will also be acquiring the Australian Government's holding of 51 per cent of the capital of New Guinea Resources Prospecting Co. Ltd. That company, which is investigating hydroelectric developments in Papua, will then become a wholly owned subsidiary. The large alumina works at Fria in Guinea, in which British Aluminium has an investment with American, French, Swiss and German interests, came into satisfactory production early this year and regular shipments of alumina are being made.

The directors of British Aluminium's subsidiary, Canadia British Aluminium Co. Ltd. report that, arising from difficulties of a technical nature associated chiefly with the running-in of the new Baie Comeau smelter, output for the year totalled 86,450 s.tons as compared to an installed capacity of 90,000 s.tons, and production costs were higher than anticipated. These difficulties largely accounted for a net loss of $1,438,273. Performance has gradually been improving over the past few months and confidence is expressed that the remaining operating problems will be solved in the relatively near future.

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On returning to New York recently from a three-weeks' tour of his company's European operations, Mr. N. V. Davis, president of Aluminium Ltd., reported that the general tone of business was healthy. He stated that, while North American consumption of aluminium had been lagging this year, indications were that consumption in the rest of the western world had increased by about 15 per cent. The sales of Aluminium Ltd. for the third quarter, at approximately 163,000 tons, were 10 per cent ahead of last year. For the nine months ending September 30, 1960, consolidated sales of aluminium in all forms were 523,000 tons, compared with 443,000 tons in the corresponding period of 1959. Mr. Davis also said that sales in the U.S. had picked up in recent weeks, reflecting scattered small order buying. He further stated that for several months the company's Canadian ingot facilities had been operating at close to 90 per cent of capacity and inventories of primary metal had been built up to the desired level. Accordingly, the company was now in process of reducing production moderately to a level more nearly commensurate with the rate of sales.

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French aluminium producers announced last week that in future the basic price of aluminium would relate to Grade A5 metal having a content of 99.5 to 99.69 per cent, instead of the present system of using Grade 4 metal with a 99 to 99.4 per cent content. This adjustment, made necessary by technical progress in the industry, would bring France into line with foreign aluminium producers.

It was later announced that French domestic aluminium prices would rise by 1.25 per cent on November 1, the basic price being 2,435 francs per ton against 2,405 previously. The new basic price corresponds to a "delivered" price of 2,480 new francs per ton, which compares with a Canadian equivalent of 2,530 new francs.

WOLFRAM'S FUTURE PROSPECTS

The outlook for wolfram was discussed by Mr. F. Gates in his annual statement to shareholders of Beralt Tin and Wolfram, Ltd. After discussing the fluctuations to which the wolfram market is notoriously subject, Mr. Gates expressed the view that a runaway market, such as occurred during the Korean war, brought no lasting benefit to the company, and said that he would be well content in present circumstances with a market price fluctuating between 150s. and 200s. per unit.

During recent months the wolfram price has apparently been high enough to induce one or two producers to recommence mining operations or to increase output, but so far the extra wolfram arising from such sources has not made any great impact on the market. In this connection the chairman noted that, even with the benefit of a protective tariff of $8 per s.ton unit (bringing the price paid in the U.S. for concentrates of domestic origin up to nearly 215s. per l.ton unit, as compared with the current price in the world market of 150s.), there were now only three mines in the U.S. producing any important quantities of tungsten ore, and in one of them tungsten concentrates were obtained as a by-product. If, however, the price were to rise above 200s., more high-cost producers would doubtless be tempted to resume operations, and with the market position so delicately balanced, it would not take any great increase in world production to start another serious decline. Moreover, it should not be forgotten that the U.S. Government holds enormous stocks of tungsten concentrates accumulated during and after the Korean war under high-price contracts, from which supplies might in certain circumstances be realed to the market.

On the other hand, much research is going on, especially in the U.S., with a view to increasing the applications of tungsten's peculiar properties, particularly its very high melting point of 3,370 deg. C., in high-temperature industrial processes. If this work achieved any success, it might well lead to a substantial increase in world demand for tungsten products.

Mr. Gates quoted statistics from U.S. Bureau of Mines sources indicating that the monthly consumption of tungsten concentrate in the U.S. had risen from about 700 tons in 1957 and 450 tons in 1958 to 800 tons in 1959 and 1,200 tons during the first five months of 1960. The figures for the past two years, he pointed out, afford encouraging evidence of the increasing use of tungsten products in industrial processes in the U.S. While the wolfram market, no doubt, would always remain subject to considerable fluctuations, the long-term outlook is regarded as favourable.

JAPAN'S URANIUM NEEDS

Denison Mines Ltd. has been awarded a contract for the delivery of 6.5 tonnes of uranium oxide by the Japan Atomic Fuel Corporation. Tenders for this contract were submitted by 18 other uranium producers in various countries. Denison received an order for a similar quantity in December, 1959. Japan, which has embarked on an aggresive policy of nuclear development, has purchased 13 tonnes of uranium oxide during each of the past two years. Estimated Japanese requirements for 1961 call for the delivery of 20 tonnes.

COPPER · TIN · LEAD · ZINC

(From Our London Metal Exchange Correspondent)

Although there have been no definite facts emerging during the past week, the general undertone on the London Metal Exchange is better and members are talking more of a slight upward movement than of a continuation in the downward trend.

CHUQUICAMATA NEGOTIATIONS ALTERED

The copper price itself has shown very little movement and interest in general has not been enthusiastic, although there has been a certain amount of bear covering and some demand due to the continued strike at Chuquicamata. The contango has been maintained and stocks in official warehouses rose 315 tons to a total of 10,430 tons. On the Continent demand continues unspectacular, but if the flow of copper from Rhodesia is uninterrupted for any length of time, buying may become necessary even if only for the purpose of maintaining end of year stocks. In the U.K. demand continues at a very good level and a preliminary figure for September consumption is 65,748 l.tons as against 49,100 l.tons in August which in itself is slightly above the July figure. Stocks at the end of the month were almost unchanged at 110,300 l.tons.

In the United States the custom smelters price has been maintained and during the last few days there have been reports of European buying. Producers report a reasonable offtake although it seems certain that there was an overproduction in October. Dealer copper is still on offer below the 30 c. per lb. level but apart from overseas enquiries little business is being done. The leading brass mills have raised the price of their products, giving sufficient time for orders to be placed at the former levels if consumers so desire, but all reports indicate that there was no rush and the maneouvre appears to have failed in its probable object of off-loading accumulated stocks.

In Chile the negotiations at Chuquicamata have come to an abrupt halt and it is reported that the mediator has resigned. This being so, the strike may continue for several weeks more and the negotiations may become involved with those in connection with the new contract at Braden to replace the present one expiring at the end of this year. Finally, it was reported that the Chilean copper department has carried out an extensive survey of the present copper industry and has come to the conclusion that an agreement between the world's copper producers is necessary to solve the present problem of over-production. It remains to be seen whether, in fact, they will be able to take any action on this finding.

NO RUSH TO SELL MALAYAN STOCKS

The tin market has remained steady with the backwardation being almost completely eliminated and it is now expected that an upward movement may commence almost at any moment. Stocks rose by 89 tons to a total of 9,357 tons and the British Bureau of Non-ferrous Metals Statistics reports that tin consumption in September rose to 1,983 tons as compared with 1,696 tons during August, whilst stocks showed a relatively small decline to 11,550 tons. Of great interest is the figure for the export of tin from Malaya during October which showed only a relatively small increase over September, the figures being for October 6,937 tons and for September 6,237 tons. These seem to indicate that there was no rush to sell any existing stocks when the export quota was lifted on October 1 and seems to indicate that Malayan tin is unlikely to become a source of weakness to the market.

On Thursday the Eastern price was equivalent to £801¾ per ton c.i.f. Europe.

POSITION OF U.S. LEAD-ZINC IMPORTS

The lead and zinc situation remains unchanged with consumption of both metals running at a satisfactory rate but always with the slight feeling that there is a little bit more on offer than can willingly be taken up. There was a slight flurry in zinc at the end of the month owing to the technical position of the market but this proved to be very temporary. The only interesting statistics which have become available during the week are for the imports into the U.S. under the quotas for the month of October, and these indicate that lead ore appears to be flowing in relatively steadily whereas the rate of lead imports has been above the average permissible rate for the quarter, with the exception of Peru which is lagging well behind. With zinc ore, the indications are that all quotas, with the exception of that for Peru, will be filled before the end of the quarter but zinc imports are well below the quota levels with no metal at all coming from the Congo or Mexico.

Closing prices are as follows:

	October 27		November 3	
	Buyers	*Sellers*	*Buyers*	*Sellers*
COPPER				
Cash	£219½	£219¾	£221½	£221¾
Three months ..	£221¼	£221½	£223	£223¼
Settlement ..	£219¾		£221¾	
Week's turnover	10,625 tons		12,325 tons	
LEAD				
Current ½ month	£68⅞	£69	£68⅞	£69
Three months ..	£69⅛	£69¼	£69¼	£69⅜
Week's turnover	6,275 tons		5,825 tons	
TIN				
Cash	£795	£796	£802	£802½
Three months ..	£794	£795	£799	£800
Settlement ..	£796		£802½	
Week's turnover	795 tons		600 tons	
ZINC				
Current ½ month	£88¼	£89	£89	£89½
Three months ..	£86⅜	£86⅝	£87	£87⅛
Week's turnover	6,075 tons		7,425 tons	

London Metal and Ore Prices appear on page 515.

Mining Finance

Effect of Record Gold Price

Rather surprisingly the recent events in the London bullion market have had the effect of raising the October gold price basis for the South African gold mines by as much as 4s. to 254s. an ounce which is a high record for these monthly returns. The previous peak of approximately 251s. 3d., after allowing for the South African Reserve Bank charge, was attained in 1956. A rise of 4s. an ounce is a very important thing indeed in the lives of the marginal producers, but it has also had the effect of boosting the earnings of the newer, richer producers to fresh high records without any further increase in mill throughput.

Of the marginals, Simmer and Jack provides a good example. The profit is £6,245 against only £1,388 in September, although the tonnage milled is 1,000 less at 74,000 and costs per ton 7d. higher at 44s. 9d. To take a longer-life example, Venterspost made £8,488 more at £87,557 despite a 4,000 ton drop in crushing at 122,000 tons. Brakpan also came out well with a gain in profit from £12,561 to £17,149.

There was disappointment, however, with one or two of the marginals where some grade adjustments in the new conditions seem surprisingly to have been made already. Thus City Deep and Crown Mines have actually made less than in September. Reduced tonnage played its part in the latter's results.

City Deep milled 4,000 tons more at 121,000, but with costs higher and grade slightly down at 4 dwts. a ton the profit of £5,012 compares with £5,043 in September. Rand Leases in the Anglo-Transvaal group is another one to disappoint, its profit of £5,452 being nearly £2,500 lower than in the preceding month despite tonnage maintenance. Cost per ton is 1d. down at 35s. 6d., but the grade has been reduced from 2.89 to 2.82 dwts. As it now looks as though the November gold price may be at least as high as that for October, the returns from these "disappointments" will be particularly interesting when they come along early next month.

To turn to the bigger guns the following are the mines that have achieved record profits in October together with the actual amounts made : Western Holdings £908,996, Free State Geduld £674,589, Vaal Reefs £406,425, Harmony £586,597, St. Helena £405,714, Winkelhaak £183,940, West Driefontein £1,169,893, Doornfontein £256,496, Libanon £75,638, Vlakfontein £92,630 and Buffelsfontein £552,546. Vaal Reef's surplus is up by as much as £18,983 compared with September and represents a gross earnings rate of 8s. 9d. a share. There is as yet no liability for tax. Western Holdings' earnings have crossed £900,000 for the first time and this mine is now in line to be the second to attain £1,000,000 a month. West Driefontein was, of course, the first.

The boost in the returns for the last quarter of 1960 augurs well for the December half-yearly dividend season. The next declarations for the Orange Free State mines, however, are not due until March.

LONDON MARKET HIGHLIGHTS

After the wild swings in share prices that had accompanied the previous week's gold rush, South African Golds settled down to a much quieter, but very firm, tendency last week. Sentiment continued to be influenced by the increasing U.S. gold loss and the accompanying firmness of the metal on the London bullion market.

Demand tended to be rather selective, although Cape buyers were always willing to take shares of the leading producers and finance houses. The most consistently firm share was undoubtedly Western Holdings which rose from the previous Friday's 148s. 1½d. to 154s. 4½d. on Wednesday evening. The move was helped only to a small degree by the new record profit earned by the mine in October : although the October profits generally were excellent as a result of a 4s. increase in the gold price received for that month they failed to make the impact that might have been expected on Wednesday morning's share market.

Older mines continued to improve, with demand finding shares in short supply. Despite an unexpected lack of improvement in the October surplus, City Deep at 22s. 3d. showed a rise of 2s. 3d. over the three days and East Rand Proprietary moved up 2s. during the week to 36s. 6d.

The finance group followed the quietly firm trend and for the most part prices showed only modest movements. Rand Mines were an exception with a strong advance of 6s. 3d. to 92s. 6d. following a persistent demand—much of it from Johannesburg—in a market none too well supplied with stock.

A welcome recovery occurred in the Copper group for a while following the better tendency on Wall Street coupled with a feeling that the recent slide in share prices here had gone far enough. This was also helped by the fact that the Paris and Brussels markets which have steadily sold stock in London for a long time now were closed for the two-day All Saints holiday.

When the Continental markets re-opened on Wednesday the recovery in Coppers was checked, but closing prices were reported to be steady. Nchanga, which had started on the Monday morning at 45s. and risen to 47s. on Tuesday, reacted to 45s. 9d. before closing at 46s. 3d. Most other stocks were still above the previous Monday morning's prices, Chartered showing a net improvement of 1s. at 69s. and Rhokana one of 9d. at 43s. 3d. Messina, however, showed no hesitation and rose steadily to 17s. 7½d. on hopes of a good final dividend this month.

Signs of a tentative recovery were noted in Tin shares at the beginning of the week and a return of Singapore inquiries on Wednesday brought a widespread revival in share prices. Malayan jumped 1s. to 22s. 6d., being helped by anticipations of a good final dividend while consideration of the high yield potential lifted Tanjong 9d. to 23s. 3d. among many smaller improvements.

Elsewhere, Mount Isa fell back 2s. 6d. to 47s. and after having spurted 5s. 7½d. to 36s. 3d., Rio Tinto were looking rather uncertain at 35s. immediately in front of the news of a substantial increase in its shareholding in Rio Tinto Mining Co. of Canada.

NEWS FROM THE WEST WITS LINE

There is a good deal of interesting information in the annual chairmen's statements for the South African gold mines in the Consolidated Gold Fields group that ended their financial years on June 30. (See pages 513-516.)

In the report of Doornfontein there is the expected further information about the proposed new shaft. The cost is estimated to be about £2,500,000. The finding of this out of profits, together with the start of tax liability, means, Mr. W. M. Walker says, that some reduction in dividend must be anticipated. For 1959-60 Doornfontein paid 3s. per 10s. share in two equal half-yearly instalments. The first distribution for the current financial year is due next month.

The shaft will be 26 ft. in diameter and full-scale sinking is expected to start in November, 1961, with commissioning scheduled by December, 1965. It will serve three main purposes. Its hoisting capacity will replace that now provided by the Annan shaft which will by the end of 1965 be facing the depletion of the Carbon Leader in the upper levels of the eastern part of the mine. It will provide additional ventilation facilities for the western-spreading workings and it will permit exploratory work in the western part of the mine. Doornfontein are 28s. 3d. to yield 10.6 per cent on the 1959-60 payment. They thus look to be already discounting some cut in the dividend, a cut that should not be a severe one.

Expansion at West Driefontein is progressing well and the chairman, Dr. W. J. Busschau, is able to say that the milling rate from the Ventersdorp Contact reef is likely to reach 75,000 tons a month during the year to June, 1964, which is earlier than originally expected. This will bring the overall mill rate, including the Carbon Leader, up to a planned 205,000 tons monthly compared with 130,000 tons in October.

Venterspost will this year exhaust the special amounts set aside to help with capital expenditure, but Mr. J. W. A. Wright thinks that the continuing high rate of outlay under this heading should not affect the dividend which was 1s. 10½d. for 1959-60. Expenditure for 1960-61 is put at £420,000 against last year's £470,616.

MAIDEN SAAIPLAAS CRUSHING

Free State Saaiplaas has announced its first monthly return from trial milling. In October 25,000 tons were crushed for a revenue of £50,827 and stoping and milling costs of £30,858. Total working costs, however, amounted to £208,500. This would include the expenses of development which the chairman, Mr. J. M. M. Ewing, says is planned to be greatly in excess of the scale that would normally be required to replace proved ore in the reserves as it is mined for the mill. It is the intention therefore, until output reaches 50,000 tons a month, to publish the whole cost of development separately from that for mining and milling.

HARTEBEEST'S WORLD RECORD

The carefully planned assault by Hartebeestfontein, the Anglo-Vaal group's Klerks-

(Continued on page 516)

ANGLOVAAL GROUP

*These extracts from the chairmen's reviews of companies associated with the Anglovaal Group are reprinted from the annual reports for the year ended June 30, 1960. Copies of the reports have been posted to all members listed on the Johannesburg and London registers of the companies. Additional copies may be obtained from the London Secretaries, Anglo-Transvaal Trustees Limited, Bilbao House, 36 New Broad Street, London, E.C.2.

HARTEBEESTFONTEIN GOLD MINING COMPANY LIMITED

At the annual general meeting in November last year, I informed shareholders that development values in the deeper area of the Hartebeestfontein mine had shown improvement since the end of June, 1959. This trend has continued. The planned rate of development in the deeper area has been well maintained and up to September 30, 1960, a total of 141,974 feet had been accomplished. Of this footage 44,619 feet were on reef and of the footage sampled approximately 82 per cent proved payable with an average value of 397 inch-dwt.

Good progress has been made in the exploratory twin haulages mentioned in my review last year. The 25th level haulage has reached the vicinity of borehole HB18, and the 225 feet of development on reef in this area has exposed values averaging 873 inch-dwt. The 29th level haulage, which will connect with No. 4 shaft, is approximately 800 feet south-east of borehole HB15. Reef development from this haulage has averaged 427 inch-dwt over a distance of 7,815 feet. The average uranium value of the payable footage sampled in the deeper area of the mine up to September 30, is 24.89 inch-lb. as compared with 35.81 inch-lb. in the shallow area.

In January of this year borehole HB23, some 3,000 feet to the west of borehole HB18 intersected Vaal Reef, and in one deflection an unusually high value was obtained. This high value together with the values obtained in the other deflections should be considered in conjunction with the information obtained in development from the 25th and 29th level haulages. The composite picture so obtained suggests that the milling grade available from the western portion of the property will be higher than was anticipated a year ago. At the present time, approximately 38 per cent of ore sent to the crusher station is derived from the deeper area, and this percentage will be increased progressively.

The monthly milling rate increased in stages from 88,000 tons in July, 1959 to 120,000 tons in April, 1960, and it is expected that the milling rate will increase to 130,000 tons per month during the second half of the current financial year. The treatment rate for the extraction of uranium increased from 105,000 tons in July, 1959 to a peak of 130,000 tons in April and May, 1960. The capacity of the treatment plant is considered adequate to ensure that the requirements of the uranium contract are met until it terminates in December, 1966. At the uranium plant, work on the final stage of converting the existing leach process to a high temperature ferric leach process has been completed. The full benefit of better uranium extraction and of lower treatment costs is expected towards the end of the present calendar year.

The combined working profit from gold and uranium production was less during the year under review, than during the previous year. Working profit from gold decreased by £267,635 to £3,603,904 while that for uranium increased by £7,567 to £3,129,890. After deducting £2,642,623 for capital expenditure, £267,083 for repayment of loans and £2,111,537 for taxation, an amount of £3,247,871 was available for distribution as dividends from the current year's surplus and the unappropriated balance brought forward. Dividends equivalent to 6s. 0d. per share absorbed £2,700,000 leaving an unappropriated balance of £547,871 at the end of the financial year.

Since the end of the financial year additional loan finance of £750,000 has been raised by means of building society bonds over some of the houses and flats owned by the Hartebeestfontein mine in Stilfontein and Klerksdorp. Repayment of these loans will be made in monthly instalments over a period of approximately 20 years. In October, 1960, £400,000 was repaid to the Anglo American Corporation of South Africa Limited, leaving £500,000 outstanding.

Capital expenditure during the year totalled £2,651,188. During the current year capital expenditure is estimated at about £2,000,000 principally on development in the deeper area and on the No. 4 shaft system.

At No. 4 shaft the erection of buildings on surface, and the installation of much permanent equipment took place during the year under review. The shaft will connect with the 29th level haulage at a depth of 6,400 feet below surface, and is expected to intersect Vaal Reef towards the middle of 1961 at approximately 6,600 feet.

CHAIRMAN: MR. B. L. BERNSTEIN

Annual General Meeting: 11 a.m., November 29, 1960.

RAND LEASES (VOGELSTRUISFONTEIN) GOLD MINING COMPANY LIMITED

The tonnage milled during the year under review was 2,225,500 tons, an increase of 19,500 tons compared with the previous year. The increase in milled tonnage was again attributable to the increased Native labour force which was available to your mine.

Working costs increased by 2d. to 35s. 6d. per ton milled. However, the recovery grade improved by 0.057 dwt. to 2.996 dwt. per ton resulting in a working profit of 2s. 5d. per ton milled, an increase of 7d. per ton compared with the previous year.

The total profit for the year, including sundry non-mining revenue was £320,627 *(1959—£238,453)*. Appropriations for capital expenditure and taxation totalled £29,875.

The reduction of the capital of your company from 9s. 3d. to 3d. per share was confirmed by an order of the Supreme Court of the Union of South Africa on December 8, 1959, and the order was registered by the Registrar of Companies two days later. Capital repayments No. 2 and 3 of 1s. 0d. per share and 6d. per share, respectively, have since been paid to members leaving a balance of 7s. 6d. per share repayable as and when decided by your board.

During the year under review, development on the Main Reef Series below the 36th level, including the area tributed from Durban Roodepoort Deep Limited, totalled 29,901 feet. Of 16,800 feet sampled, 7,370 feet, equivalent to 43.9 per cent, proved payable at an average value of 8.83 dwt. per ton over a channel width of 34.3 inches equivalent to 303 inch-dwt. In the tributing area 8,437 feet of development were accomplished of which 5,440 feet on Main Reef and Main Reef Leader were sampled. Of this footage, 2,925 feet, equivalent to 53.8 per cent, proved payable at an average value of 8.22 dwt. per ton over a channel width of 44.5 inches, equivalent to 366 inch-dwt. It is anticipated that the development programme in the tributing area will be almost completed by the end of the current financial year.

At June 30, 1960, the total ore reserve was estimated at 2,097,000 tons, an increase of 177,000 tons compared with that at June 30, 1959. This increase is due mainly to approximately 220,000 of ore developed in the tributing area and to the policy of reducing the rate of depletion of the ore reserve.

Indications are that under current conditions, your mine will continue to operate on the present scale for approximately two years. As most of the ore in the mine is of marginal grade a small increase in costs would result in a large tonnage becoming unpayable.

Development on the Main Reef Series in the south-western portion of the mine has shown that the abnormally steep southerly dip encountered below the 29th level changes to a northerly dip below 36 level, and that this condition persists to the 42nd level which is the lowest level of the tertiary shaft system.

In order to obtain further structural information regarding this anomaly and to determine whether any other potentially payable reef horizons exist in this area, a crosscut was advanced on the 42nd level towards the south-western corner of the mine.

After traversing 1,532 feet of steeply dipping quartzites and dykes in the hanging wall of the Main Reef Series the crosscut entered 70 feet of grey granite and was stopped. A diamond drill hole dipping 5 deg. above the horizontal was then advanced from the face of the crosscut and in the same direction; at September 26, 1960, a distance of 920 feet had been drilled and further granite with some quartzite was intersected.

CHAIRMAN: MR. S. G. MENELL

Annual General Meeting: 11 a.m., November 28, 1960

EASTERN TRANSVAAL CONSOLIDATED MINES, LIMITED

The total profit earned by all branches of your company during the year under review amounted to £148,209 compared with £173,801 for the previous year. A dividend of 5 per cent (3d. per share) was paid for the year ended June 30, 1960. Net capital expenditure during the year amounted to £207,432, details of which appear in the attached reports. Included in this figure is an amount of £127,099 representing capitalization of the loan to Frantzina's Rust Timber Plantations Limited.

Equipping of the Cesca sub-vertical shaft at the Agnes mine has been completed.

The old Woodbine shaft at the extreme eastern section of the mine is being reconditioned. Thereafter it will be deepened to the elevation of the Ben Lomond adit.

The Prince Consort shaft at the New Consort mine had reached a depth of 22 feet below the 35th level at the end of the year under review and is presently being deepened to the 37th level. The pilot winze from the 33rd level has intersected the bar schist contact on the 38th level horizon and development on reef on the 37th and 38th levels is in progress.

A tributing agreement has been entered into with Barberton Mines, Limited, whereby your company has acquired the right to prospect and mine certain claims adjacent to your New Consort claim area.

At the Sheba mine development at depth in the high value Swartkopje zone has indicated that the shoot has narrowed considerably.

Surface and underground prospecting at the old Mount Morgan mine has ceased and all equipment has been withdrawn. Tests have indicated that a reasonable extraction could be obtained but the cost of the plant required to exploit the ore body at present disclosed is not economical. Geological mapping is however proceding in other sections of the Agnes area.

The total ore reserve at your company's operating mines decreased by 31,400 tons to 229,200 tons but the value rose by 1.14 dwt to 15.05 dwt per ton. There was a decrease of 19,000 tons at New Consort and 13,000 tons at Sheba while there was a small increase of 600 tons at Agnes. Operations at the Mamre mine have ceased.

Marketing of your company's timber continued to be difficult and this can, in some measure, be attributed to the fact that timber import permits have been granted by the Department of Commerce and Industries, which adversely affected the disposal of locally produced timber products at profitable levels.

The combined operations of your company's plantations and the one operating sawmill resulted in a loss of £31,374 after providing an additional £1,000 (1959—£3,000) in respect of the writing off of timber stocks, as compared with a loss of £23,319 for the previous year.

The loss on farming amounted to £5,870 as compared with a profit of £49 for the previous year. It has been decided that future activities will be confined mainly to cattle and citrus farming and to this end the citrus orchard has already been increased to 17,216 trees.

During the year your company's bankers granted unsecured overdraft facilities of up to £150,000. These facilities were obtained in order to finance the company's capital expenditure programme. It is estimated that expenditure at the current rate will continue for some considerable time because of the necessity for continued development and exploration of existing and dormant mines.

In view of my remarks in the preceding paragraph regarding capital expenditure and also as a result of the losses on non mining activities which depleted your company's cash resources, your board declared a dividend of 3d. per share, a decrease of 1½d. per share on last year's dividend.

At Frantzina's Rust Timber Plantations Limited a loss of £55,161 was incurred for the year as compared with a loss of £47,957 for the previous year due to the difficult conditions in the timber trade to which I have already referred.

CHAIRMAN: MR. L. P. KENT

Annual General Meeting: 11 a.m., November 22, 1960.

✱The annual general meetings will be held on the dates and times stated at Anglovaal House, 56 Main Street, Johannesburg. All companies referred to in this advertisement are registered in the Union of South Africa.

FREE STATE SAAIPLAAS GOLD MINING COMPANY LIMITED

The Fifth Annual General Meeting of the above-mentioned Company will be held in Johannesburg on November 8. The following is an extract from the circulated statement by the Chairman, **Mr. J. M. M. Ewing:—**

During the year work progressed without interruption on the equipping of the mine for production at a milling capacity of 50,000 tons per month. The major part of this work was completed by June 30, 1960, but insufficient ore reserves had been developed by that date to permit production to commence in July, 1960, as planned.

During the year development was retarded by intersection of water-bearing fissures requiring cementation. Good progress was, nevertheless, accomplished. The footage advanced amounted to 17,576 feet. The footage sampled on the Basal Reef totalled 6,420 feet of which 3,075 feet, equal to 47.9 per cent, proved payable at an average value of 7.0 dwt. per ton over an estimated stoping width of 52.5 inches, equivalent to 368 inch-dwt. The footage advanced from No. 2 Shaft, which is included in the above total, amounted to 11,645 feet, all of which was off reef.

While a substantial volume of development was achieved in the twelve months up to June 30, 1960, Members will note that the footage on reef and sampled during the period was only 17.1 per cent of the total work done. In the quarter to the end of September, about the same proportion of on-reef to total development persisted. As a consequence, the proving of ore reserves has been slower up to date than expected. There have been two principal causes of this heavy excess of off-reef development. The first cause has been the large amount of development required at two shafts in the period to complete the arrangements for handling rock into the shafts together with the necessity for providing the two main crosscuts on the 7th and 9th Levels to effect connection between the two shafts. The second cause of the heavy excess has been the unexpectedly low inclination of the Basal Reef which has been found to be approximately 4 degrees in the area explored. This feature, combined with the occurrence of minor geological faults, results in the need for long crosscuts to gain access to the reef. Every effort is being made to raise the rate of development achieved on the plane of the Basal Reef insofar as the physical conditions of the strata will permit.

The mine is fully equipped to produce at the rate of 50,000 tons per month. In October, trial milling commenced. The mill is currently being supplied with ore obtained from stoping, from development and from an ore dump on the surface. Output will be increased and the proportion of rock supplied from these sources will be modified as the establishment of ore reserves progresses.

In a report dated July 5, 1960, the Company's Technical Advisers reviewed the situation at the mine as at June 30, 1960, and stated that it was estimated expansion of production could be carried out in accordance with a schedule showing attainment of an output of 100,000 tons per month in March, 1962 provided the payable exposures on the Basal Reef in the future are in accordance with reasonable expectations based on the information obtained from current underground development and intersections of Basal Reef previously obtained in surface boreholes and if appropriate finance were provided. It was estimated that the programme would require the provision of an additional £3,000,000 over and above the existing funds in hand and the working profits to be obtained from milling up to December 31, 1961, after which all expenditure on capital account should be met from working profits. As already mentioned, this £3,000,000 has been provided and operations are at present being directed towards the objective of production at 100,000 tons per month in accordance with the Technical Advisers' recommendations.

DOORNFONTEIN GOLD MINING COMPANY LIMITED

The Thirteenth Annual General Meeting of the above-mentioned Company will be held in Johannesburg on November 11. The following is an extract from the circulated statement by the Chairman, **Mr. W. M. Walker :—**

During the year under review No. 1A Sub-Vertical Shaft was sunk 1,275 feet to a depth of 1,360 feet below 15 Level Collar. Stations to serve 17, 19, 21 and 23 Levels were cut and supported and the shaft was equipped to a depth of 1,260 feet.

In accordance with the main programme for the exploitation of the mining lease area, the time has now arrived when it has become necessary to sink a new shaft from surface and preliminary work in this connection was commenced towards the end of the year under review. The situation of the new shaft, which will be known as No. 2 Shaft and which will be sunk to a depth of 6,000 feet below surface, is shown on the plan accompanying the Annual Report. The shaft will be 26 feet in diameter and will be equipped to hoist rock, men and materials. Full scale sinking of the shaft is planned to start in November 1961, and it is expected that the shaft will be commissioned by December, 1965. It has been estimated that the total cost of the shaft and ancillary equipment will be about £2½ million.

When completed No. 2 Shaft will serve three main purposes. Firstly, its capacity for hoisting ore will be required to replace that now provided by Annan Shaft which, as from about December, 1965, will be required to hoist less and less rock as the Carbon Leader in the upper levels of the mine served by that shaft gradually becomes depleted. Secondly, the shaft will provide the additional ventilation facilities which will be required as the distance of the workings from No. 1 Shaft increases both on dip and in a westerly direction from that shaft. Thirdly, the shaft will permit the undertaking of exploratory work in the western portion of the mining lease area.

Development carried out to the west of No. 1 Shaft during the year has confirmed earlier indications that the Carbon Leader will be mined at least as far to the west of No. 1 Shaft as it is now being mined to the east of the shaft and development results have been sufficiently encouraging to warrant a decision to make a further increase in the milling rate. Arrangements are, therefore, being made to increase the capacity of the reduction works to 125,000 tons per month and it is expected that the milling rate will be gradually increased during the current financial year. In order to provide the requisite additional hoisting capacity, work is now in hand to make the hoisting arrangements at No. 1 Shaft semi-automatic.

It is expected that, as the result of the increase in the milling rate, working profits during the current financial year will be greater than those obtained during the previous year. On the other hand, by virtue of the decisions to start the sinking of No. 2 Shaft and to increase the milling rate, capital expenditure during the current financial year will probably exceed £1¼ million, while expenditure on capital account is likely to remain at a higher level than that of the past few years until the completion of No. 2 Shaft. The effects of the higher rate of capital expenditure, however, will be partly offset by the increase in working profits which will flow from the expansion in the rate of production.

As Members have been advised in the past, the Company's property is classified as a "new gold mine" for tax purposes and, as such, is not liable to pay formula tax until such time as its total profits exceed the total of its allowable capital expenditure. That time has now arrived and, in consequence, the Company will be liable for formula tax during the current financial year. In terms of the Income Tax Act the Company will, for tax purposes, be allowed to charge all future capital expenditure against profits as soon as the expenditure is incurred.

Although the Company will be liable for formula tax during the current financial year, it is not expected that it will become liable for the payment of State's share of profit until some time during the financial year ending June 30, 1963.

Although it is expected that working profits during the current financial year will be greater than those earned during the previous year, the increase in profits will be insufficient to offset the increase in the rate of expenditure on capital account. All other things being equal this, together with the fact that the Company is now liable for the payment of formula tax, will mean that the profit available for distribution will inevitably be less than that for the previous year and consequently some reduction in dividend must also be anticipated.

WEST DRIEFONTEIN GOLD MINING COMPANY LIMITED

The Fifteenth Annual General Meeting of the above-mentioned Company will be held in Johannesburg on November 11. The following is an extract from the circulated statement by the Chairman, **Dr. W. J. Busschau :—**

During the year under review further satisfactory progress was made with the scheme for expansion of production and accordingly there was a marked improvement in the results of operations. In February, 1960, the company was able to declare a monthly working profit of £1,003,672 and since then, with the exception of March, 1960, when results were adversely affected by a reduction in the electric power supply, the company has been able to maintain its profits at a rate of over £1,100,000 per month. During the year 1,360,000 tons of ore were treated for the extraction of gold at an average yield of 18.366 dwt. per ton, the comparative figures for the previous year being 1,021,000 tons and 18.789 dwt. per ton respectively.

During May, 1960, it was decided that £3,520,540 of the balance on Share Premium Account be capitalized, and applied in paying up in full at par 7,041,080 shares of 10/- each, which shares were issued credited as fully paid to Members in the ratio of one capitalization share for every share held. In order to give effect to this decision it was necessary to increase the Authorized Capital of the Company from £3,750,000 divided into 7,500,000 shares of 10/- each to £7,050,000 divided into 14,100,000 shares of 10/- each, of which 14,082,160 shares of 10/- each have been issued.

Dividends of 4/9d. and 2/7½d. (on the increased capital) per share were declared in December, 1959, and June, 1960, respectively. The total amount distributed to Members was £3,520,540 which represents an increase of £616,095 when compared with the amount distributed during the previous year.

At No. 4 Shaft shaft sinking operations were recommenced in February, 1960, and by June 30, 1960, the shaft had been sunk a distance of 911 feet to a depth of 2,578 feet.

At No. 5 Shaft the change-over to permanent hoisting arrangements and the cutting of the ore pass system to provide suitable hoisting facilities for the Ventersdorp Contact Reef horizon were completed.

No. 5A Sub-Vertical Shaft was sunk a distance of 1,523 feet to a depth of 2,253 feet below 18 Level Collar. Stations to serve 22, 24, 26, 28 and 30 Levels were cut and supported and work on the permanent hoisting arrangements on 16 Level was completed.

On August 10, 1959, the Carbon Leader was intersected in No. 5A Sub-Vertical Shaft at a depth of 993 feet below the collar on 18 Level. The exposure was complete and the 16 sections sampled around the periphery of the shaft averaged 290.8 dwt. of gold per ton and 3.32 lb. of uranium oxide per ton over a reef channel width of 9.1 inches, equivalent to 2,646 inch-dwt. and 30.2 inch-lb. respectively.

The total footage sampled on the Carbon Leader Reef amounted to 11,785 feet of which 11,510 feet, equal to 97.7 per cent, proved to be payable at an average gold value of 18.3 dwt. per ton and an average uranium oxide content of 0.27 lbs. per ton over an estimated stoping width of 42.0 inches, equivalent to 769 inch-dwt. and 11.3 inch-lb. respectively. In addition to this development a total footage of 1,372 feet was advanced on the Carbon Leader Reef in the area held under prospecting permit beyond the north-western boundary of the Company's mining lease area. Of this 385 feet were sampled of which 310 feet, equal to 80.5 per cent, proved payable at an average value of 15.2 dwt. per ton over an estimated stoping width of 42.0 inches equivalent to 638 inch-dwt.

The development footage advanced on the Ventersdorp Contact Reef amounted to 21,830 feet which compares with the total of 1,035 feet advanced during the previous year. The total footage sampled amounted to 6,395 feet, of which 5,270 feet, equal to 82.4 per cent proved to be payable at an average value of 17.8 dwt. per ton over an estimated stoping width of 43.7 inches equivalent to 778 inch-dwt.

During the year under review satisfactory progress was made with the

implementation of the decision to increase the rate of production to a milling rate of 205,000 tons per month by July, 1964. In accordance with this decision, which was referred to in my Statement to Members last year, the rate of milling of ore from the Carbon Leader Reef was increased to 130,000 tons per month by April, 1960, and has since been maintained at that rate. The results of development carried out to date on the Ventersdorp Contact Reef have been very encouraging and, accordingly, it is envisaged that the milling of ore from this reef will commence towards the end of the current financial year and that it will reach the rate of 50,000 tons per month by July, 1961, as originally planned. It now appears to be likely that the rate of milling of ore from this reef will reach 75,000 tons per month during the year ending June 30, 1964, which is earlier than originally expected.

Further good progress was made during the year with shaft sinking and equipping, with surface construction work and extensions to the reduction plant required by the expansion programme. During the year the supply of Native labour continued to improve, which facilitated this work.

In July, 1960, the Harvie-Watt Shaft passed through the Main Reef horizon at a depth of 6,000 feet below collar. Due to disturbed ground and incomplete reef exposure it was not possible to obtain a satisfactory sampling; the sections sampled proved unpayable. This result was not unexpected as it will be recalled that Borehole No. 17 on the site of this shaft also disclosed unpayable values on the Main Reef.

In August, 1960, the Carbon Leader Reef Zone, consisting of a succession of conglomerate reef bands, was intersected in the Harvie-Watt Shaft at a depth of 6,172 feet below collar and approximately four to five feet below the Green Bar Marker. Sampling was carried out in 16 sections at intervals of 5 feet around the periphery of the shaft and the results averaged as follows :—

	Parting (inches)	*Channel Width* (inches)	*Channel Value* (Dwt/ton)	*Inch-dwt*
Band No. 1 ... (uppermost)		11.7	2.9	34
	63.9			
Band No. 2 ...		83.6	0.6	47
	47.1			
Band No. 3 ...		85.4	1.8	150
	34.2			
Band No. 4 ... (lowermost)		32.3	0.6	19

These values are not inconsistent with previous Carbon Leader values disclosed elsewhere on the mine.

The sinking of this shaft has almost reached its final depth of 6,590 feet. The shaft is scheduled to be brought into commission during the latter half of 1961.

Net expenditure on capital account for shaft sinking, plant and equipment totalled £438,267 the major part of which was incurred in connection with the Harvie-Watt Shaft. It is not likely that capital expenditure during the current year will be less than that incurred during the year under review.

It is hoped to maintain the higher milling rate which has been achieved but it will be appreciated that this is dependent upon the continuance of the satisfactory supply of Native labour which has been available over the past two years.

I have already referred to the encouraging results which have so far been obtained from development on the Ventersdorp Contact Reef horizon in the southern portion of the mine. To what extent this reef will contribute tonnage to the mill in the future and enhance average yield, which results to date appear to indicate might be possible, can only, as already stated, be determined after the completion of further work on this horizon.

LIBANON GOLD MINING COMPANY LIMITED

The Twenty-Fourth Annual General Meeting of the above-mentioned Company will be held in Johannesburg on November 10. The following is an extract from the circulated statement by the Chairman, **Mr. W. M. Barclay :—**

The maintenance of a satisfactory supply of Native labour enabled the milling rate, which was increased during the second half of the previous year, to be continued at a higher level during the year under review when the tonnage milled increased by 156,000 tons to 1,350,000 tons. There was a slight decrease in yield from 4.730 to 4.717 dwt. per ton milled but the higher tonnage and lower working costs, at 47/10d. per ton milled, resulted in an improvement of £96,783 in the working profit compared with the previous year.

Good progress was made in the development programme on the Ventersdorp Contact Reef horizon south of No. 2 Shaft on 15, 17 and 18 Levels during the year under review and promising results, in regard to both values and payability, have been disclosed. Further work on this reef horizon is, however, necessary before its economic potentialities can be fully assessed.

Main Reef development was advanced throughout the mine and sampling results were again satisfactory. Further ore reserve blocks were defined on this horizon to the east of the No. 1 Sub-Vertical Shaft.

LONDON METAL AND ORE PRICES, NOV. 3, 1960

METAL PRICES

Aluminium, 99.5%. £186 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £200 per ton
Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. lb. nom.
Cadmium 10s. 6d. lb.
Cerium (99%) net, £15 0s. lb. delivered U.K.
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.
Cobalt, 12s. lb.
Germanium, 99.99%, Ge. kilo lots 2s. 5d. per gram
Gold, 258s. 0d. (at Thursday's fixing)
Iridium, £20/£23 oz. nom.
Lanthanum (98%/99%) 15s. per gram.
Magnesium, 2s. 2½d./2s. 3d. lb.
Manganese Metal (96%/98%) £275/£285
Nickel, 99.5% (home trade) £600 per ton
Osmium, £18/£22 oz. nom.
Osmiridium, nom.
Palladium, Imported, £8 12s. 6d.
Platinum U.K. and Empire Refined £30 5s.
Imported £28½/£28¾
Quicksilver, £70½ ex-warehouse
Rhodium, £43/£45 oz
Ruthenium, £14/£16 oz. nom.
Selenium, 46s. 6d. per lb.
Silver, 79½d. f. oz. spot and 79½d. f'd.
Tellurium, 28s. 6d. lb.

ORES AND OXIDES

Antimony Ore (60%) basis		21s. 6d./22s. 6d. per unit c.i.f.
Beryl (min. 10 per cent BeO)		240s./245s. per l. ton unit BeO
Bismuth		65% 8s. 6d. lb. c.i.f.
		18/20% 1s. 3d. lb. c.i.f.
Chrome Ore—		
Rhodesian Metallurgical (semifriable 48%)	(Ratio 3 : 1)	£15 5s. 0d. per ton c.i.f.
" Hard Lumpy 45%	(Ratio 3 : 1)	£15 10s. 0d. per ton c.i.f.
" Refractory 40%		£11 0s. 0d. per ton c.i.f.
" Smalls 44%	(Ratio 3 : 1)	£13 5s. 0d. per ton c.i.f.
Baluchistan 48%	(Ratio : 3 : 1)	£11 15s. 0d. per ton f.o.b.
Columbite, Nigerian quality, basis 70% combined pentoxides	(Ratio 10 : 1) Nb_2O_5 : Ta_2O_5	170s./175s. per l. ton unit c.i.f.
Fluorspar—		
Acid Grade, Flotated Material		£22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF_2)		156s. 0d. ex. works
Lithium Ore—		
Petalite min. 3½% Li_2O		50s. 0d./55s. 0d. per unit f.o.b. Beira
Lepidolite min. 3½% Li_2O		50s. 0d./55s. 0d. per unit f.o.b. Beira
Amblygonite basis 7% Li_2O		75s./85s. per ton f.o.b. Beira
Magnesite, ground calcined		£28 0s./£30 0s. d/d
Magnesite Raw (ground)		£21 0s./£23 0s. d/d
Manganese Ore Indian—		
Europe (46%-48%) basis 60s. 0d. freight		73d./75d. c.i.f. nom.
Manganese Ore (43%-45%)		69d./71d. c.i.f. nom.
Manganese Ore (38%-40%)		nom.
Molybdenite (85%) basis		8s. 11d. per lb. (f.o.b.)
Titanium Ore—		
Rutile 95/97% TiO_2 (prompt delivery)		£28 0s. 0d. per ton c.i.f. Aust'n
Ilmenite 50/52% TiO_2		£11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%)		148s. 0d./153s. 0d. per unit c.i.f
Vanadium—		
Fused oxide 95% V_2O_5		8s./8s. 11d. per lb. V_2O_5 c.i.f.
Zircon Sand (Australian) 65-66% ZrO_2		£16/£16 10s. ton c i.f

English Mining Engineer requires interesting position, home or abroad with progressive company where there are prospects of permanency and promotion. Whilst main experience has been obtained in mechanized coal mines, would prefer change. Experience also in rock heading organization and methods and work study. Degrees in Civil and Mining Engineering. Knowledge Spanish. Aged 36, married with 3 children. Available in January. Please reply Box 687. *The Mining Journal Ltd.*, 15 Wilson Street, London, E.C.2.

MINING FINANCE (*continued*)

dorp area gold mine, on the world shaft-sinking record has succeeded. In October 1,106 ft. were advanced in the No. 4 shaft thus easily beating the previous best of 1,020 ft. at President Steyn. The sinking was done in 31 days, a daily average of 35.7 feet. The tonnage excavated was 52,000 and the best blast to blast time was 4¼ hours.

In his annual statement the chairman, Mr. B. L. Bernstein, says that the shaft will connect with the 29 level haulage at a depth of 6,400 ft. below the surface and that it is expected to cut the Vaal Reef towards the middle of next year at approximately 6,600 ft. It seems possible that this expectation may now be improved upon. Meanwhile, capital expenditure for 1960-61 is put at another £2,000,000, principally on development in the mine's deeper area and, of course, on the No. 4 shaft.

The cut in the half-yearly dividend rate from 3s. 6d. to 3s. thus looks likely to persist. The next declaration is due in December. At 48s. 6d. the 10s. shares yield 12.4 per cent before allowing for double tax relief.

Chairman's statement is on page 512.

WIT NIGEL FACES A DECISION

Witwatersrand Nigel, the Eastern Rand gold producer, is faced with the prospect of having gradually to withdraw from its Houtpoort section unless reef development results improve, which they appear unlikely to do. It is hoped that this can be done without disrupting operations. It would take some years to carry through. In that period the Houtpoort reserves would be mined out and steps taken to increase the tonnage from the other part of the property, Poortje. Naturally the success of the plan depends, as the chairman Mr. S. F. Dench points out, on the continuance of satisfactory reef exposures at Poortje.

No final decision on the matter has yet been reached. Shareholders will be advised when it is. Meanwhile, profits are holding up (the gold price increase will be helpful in this respect) and it looks as though the 5 per cent dividend on the 2s. 6d. shares should be maintained. They stand at 1s. 3d.

Chairman's statement is on page 517.

VENTERSPOST GOLD MINING COMPANY LIMITED

The Twenty-Sixth Annual General Meeting of the above-mentioned Company will be held in Johannesburg on November 10. The following is an extract from the circulated statement by the Chairman, **Mr. J. W. A. Wright** :—

The higher net profit enabled the Board to increase the rate of dividend from 10½d. per share per half year at which level it had remained since December, 1956, to 1/- per share in June last.

The prominent features of the development results are :—

(i) A decrease in the development footage advanced of 6,161 feet, occasioned mainly by the lack of points of attack on the Main Reef horizon, accentuated by the erratic payability of that reef in the No. 1 Sub-Vertical Shaft area. This condition should be eased early in 1961 when development operations expand from the No. 3 Sub-Vertical and No. 2B Tertiary Incline Shafts, which are situated in more promising areas of the Main Reef.

(ii) The continuance of satisfactory development on the Ventersdorp Contact Reef, particularly in the area south of No. 1 Sub-Vertical Shaft and also in the No. 3 Sub-Vertical Shaft area, where, however, development on this horizon was limited by ventilation considerations. In view of the promising development on the Ventersdorp Contact Reef in the No. 1 Sub-Vertical Shaft area, steps have been taken to acquire the mineral rights of 11.1 morgen adjoining the easterly boundary of the present mining title.

The ore reserve fully developed at June 30, 1960, is estimated to be 2,190,000 tons, averaging 6.3 dwt. per ton over a stoping width of 54.9 inches. Of this total, 1,163,000 tons, averaging 4.5 dwt. per ton over a stoping width of 57.9 inches, is on the Main Reef and 1,027,000 tons, averaging 8.5 dwt. per ton over a stoping width of 51.9 inches is on the Ventersdorp Contact Reef.

Satisfactory progress continued to be made with the shaft sinking programme at No. 2B Tertiary Incline and No. 3 Sub-Vertical Shafts, which are designed to open up the southerly and deeper portions of the claim area. In the former shaft, the first stage of the sinking scheme was completed towards the end of the year under review when the shaft was equipped to 23 Level and the main orepass system to serve 21 and 22 Levels and the hoist were brought into commission. Preparatory work has now commenced on the second stage of the scheme, which is to sink the shaft to 25 Level. This will provide access to the Main Reef on 23 and 24 Levels and, provided development from there is sufficiently encouraging, a third stage to sink the shaft to 27 Level will probably follow in due course.

At the end of June, 1960, sinking in the No. 3 Sub-Vertical Shaft was nearing completion and was finished early in August when it reached 23 Level at its final depth of 2,553 feet below 10 Level. The shaft is now being equipped and is expected to be fully in commission by the middle of 1961. If development from this shaft proves encouraging, consideration will require to be given at a later date to some extension to depth of the shaft system, but no decision will be taken until more is known about reef conditions.

Members will have noted that for the first time separate figures have been given of the make-up of the tonnage comprising the ore reserve. This serves to emphasize that the gold produced at the mine is derived from two sources of which the average gold content of one, the Ventersdorp Contact Reef at 8.5 dwt. per ton is considerably higher than the average content of 4.5 dwt. per ton of the other, the Main Reef. If the fullest advantage is to be obtained from the potentialities of the mine as a whole, not only is it essential that ore be brought to the mill in quantities proportional to the quantity of each reef comprising the ore reserve, but it is also necessary to plan future development of the estimated intact tonnage on each reef, so as to maintain a balance which will allow the two sources to be mined in such a manner as to give the best results. This latter aspect, particularly in view of the erratic nature of the development on the Main Reef in the No. 1 Sub-Vertical Shaft area, at times presents some difficulty.

While the level of future dividends must depend largely upon actual working costs and the amounts to be appropriated for capital works, current estimates again indicate that it should be possible to finance the remainder of the present capital expenditure programme and to maintain the dividend rate.

RIO TINTO INCREASES SHAREHOLDING IN CANADIAN SUBSIDIARY

The Rio Tinto Company has acquired the whole of Mr. J. H. Hirshhorn's shareholding in the Rio Tinto Mining Co. of Canada which in turn holds practically all the shares in Rio Algom, the recently constituted holding company for the uranium mines in the Blind River area of Ontario, namely Algom, Milliken, Northspan and Pronto. The effect of this deal is to give the Rio Tinto parent company more than 80 per cent of the equity in Rio Tinto Mining Co. of Canada, as against 54 per cent previously. The only other substantial shareholder is now the Societé Generale with a holding of about 10 per cent. The price at which Mr. Hirshhorn's shareholding has been acquired is understood to be somewhat below the current market price of 80 c. per share which suggests that the total cash consideration involved may have been near to £4,000,000. As Tinto of Canada had generally been supposed to be expecting a cash flow from Blind River of around £15,000,000 between now and the end of the uranium contracts, it looks as if the parent company is acquiring entitlement to an additional £5,000,000 over the next six years, plus a much greater measure of control at a fair price.

Hitherto the profits of the Rio Tinto Co. have not received any appreciable benefit from the earnings of the Canadian subsidiary, and despite the very large cash flow which will be coming from Blind River, it is doubtful whether it will prove advantageous to the parent company to transmit any of these profits back to the U.K., at least so long as the pioneer reliefs granted by the Canadian Government are not allowable for D.T.R.

Indirectly, however, the accumulation of these substantial cash assets in the Canadian company may well benefit the Rio Tinto shareholder in that these reserves may permit of a more liberal distribution of profits earned from other sources than would otherwise be prudent.

Meanwhile, with so much cash in sight, the Canadian company's sights must now be set primarily on the possible outcome of present prospecting operations within Canada and also no doubt on the possibility of having a financial participation in Tinto activities in other parts of the world.

WITWATERSRAND NIGEL

MR. S. F. DENCH'S STATEMENT

The twenty-seventh ordinary general meeting of Witwatersrand Nigel Ltd., will be held on December 1 in Johannesburg.

The following is the Statement of the Chairman, **Mr. S. F. Dench,** circulated with the Report and Accounts for the year ended June 30, 1960 :—

The tonnage milled during the year was 226,900 which was 11,900 tons higher than that for the previous year, but the grade of ore milled, which was 4.626 dwts. per ton, was lower by 0.206 dwts. Working costs, excluding development, were 3d. per ton higher than for last year, but as development costs were reduced by 1s. 10d. per ton overall working costs were 1s. 7d. per ton lower.

Development Results

The footage developed was practically unchanged at 21,347 feet but the payability which was 25.4 per cent. and the value at 238 inch-dwts. both showed small decreases. Development in the Houtpoort Section continued to be disappointing; not only has the occurrence of the major dyke to which reference was made last year, displaced the reef, but an apparent sill phase of the dyke has partly occupied the reef position on the southern side of the dyke. The position in that area of the mine has been further complicated by the fact that a change in direction of the ore shoot has moved it under a Burgerright Reserve where the mineral rights are owned by the surface owners whose stands average less than one-sixth morgen each. Efforts to acquire the mineral rights have generally failed.

Development in the No. 7 Shaft (Poortje Section) area disclosed further evidence of the existence on that section of the mine, of the normal shoot system of the Far East Rand.

The estimated ore reserve at June 30, 1960, was 770,800 tons averaging 4.7 dwts. per ton over a stoping width of 37 in. This represents an increase of 17,500 tons compared with the previous year and a decrease in value of 0.1 dwt. per ton. Of this ore reserve 386,400 tons was located in the Poortje Section.

Unless conditions improve in the Houtpoort Section during the current year, with increased payability, indications of which at present do not appear very hopeful, then measures will be taken for the withdrawal from Houtpoort and the transfer of all operations to the Poortje Section. Such an operation would take some years to carry through during which period the ore reserves on the Houtpoort Section will be mined out and arrangements made for an increased tonnage to be milled at Poortje. It is considered that such a plan could be carried out without any major disruption of production, provided satisfactory reef exposures continue to be made at Poortje. However, the final decision has not yet been reached and members will be advised should development be stopped at Houtpoort.

Profit and Dividend

The net profit for the year amounted to £64,259 as compared with £73,463 for the previous year. Profits for the current year are expected to continue at approximately the same level. Your Company still has no liability for gold mining taxation. Capital expenditure during the period amounted to £4,488 all of which was spent on the No. 7 Shaft reduction works. Expenditure on capital account during the current year is expected to be very small.

Dividend No. 6 of 5 per cent was declared payable to shareholders registered at June 30, 1960.

There was no change in the constitution of the Board of Directors during the year.

I have pleasure in expressing the Board's appreciation of the excellent services rendered during the past year by the Mine Manager, Mr. J. A. D. Wingfield and I would also like to pay tribute to the efficient services rendered by the technical and administrative staffs at Head Office and the London Office and the employees at the Mine.

CLUTHA RIVER GOLD DREDGING

The twenty-sixth annual general meeting of Clutha River Gold Dredging, Ltd., was held on October 27, at 73 Cheapside, E.C.2.

The Chairman, **Mr. F. G. Payne, M.I.Mech.E.,** presided and the following is an extract from his Statement circulated with the Report and Accounts for the year ended March 31, 1960 :—

The profit before taxation amounts to £8,860. The net profit after charging £2,587 for taxation amounts to £6,273. The New Zealand Income Tax attributable to the repayment of Capital amounts to £6,777 and has been charged to the General Reserve. £1,248 has been written off Mining Land, Licences, and Prospecting Expenditure. A dividend of one penny per share is recommended, which will absorb £5,104 leaving a balance of £3,187 to be carried forward to the current year. If sanctioned, the dividend will be paid on October 29.

The average price received for our gold during the year was £12 8s. 10d. per fine ounce, compared with £12 9s. 4d. for the previous year.

The expenditure in New Zealand amounted to £61,265 compared with £58,463 in the previous year. The increase of £2,802 was due to the additional cost of dredge repairs, rises in wages, and extra power costs. The New Zealand Arbitration Court issued a General Wage Order in October and also a new Award was negotiated in December. The additional cost to this Company of these increases is estimated at £1,600 in a full year. During the year a new electric power supply agreement was negotiated but owing to rising costs it was not possible to arrange such favourable terms as in the case of the old agreement and the extra cost of power under the new agreement is estimated at approximately £800 per annum.

It was necessary to reduce our Deposits and sell a number of investments to make the Capital Repayment, which inclusive of the New Zealand Tax and expenses, cost the Company approximately £32,500.

With reference to operations at the Mine, the dredge worked satisfactorily during the first half of the year, but between the end of November and the end of March there was an abnormal series of breakdowns. The dredge ran into unexpectedly hard ground, and this caused additional strain on the digging equipment, and also reduced the digging rate. The bucket chain parted on four occasions, but was successfully repaired in each case. A major stoppage was due to the necessity of replacing the top tumbler with the new tumbler in stock. The lost time for the whole year due to stoppages and repairs amounted to 850 hours as compared with only 228 hours in the previous year. The General Manager, and his Staff, did exceedingly good work in overcoming these difficulties, and were unstinting in the overtime they worked so as to cut down the delays as much as possible.

In regard to the current year, for the first fortnight in April the dredge was inoperative, due to the major overhaul of the stacker equipment which is necessary once every three years. Up to September 16 the dredge has recovered 3,111 ounces and worked 2,503 hours, compared with 3,452 ounces and 2,891 hours in the previous year.

The dredge has now reached the eastern boundary of Block 5, and is making the turn to work back on its westward course. The plant is running satisfactorily and a new bottom tumbler has been installed. Both the new top and bottom tumblers greatly improve the operation of the bucket chain. With the major overhauls completed it may be possible to cut down running costs to compensate, in part at any rate, for the increases in wages and cost of power mentioned in the earlier part of my statement.

Chairman's Additional Remarks

The Chairman, addressing the meeting, said :—

Since this year's report was sent to you there has been quite a flurry in the price of gold on the free market, even in London where it is usual for the price to vary only by a few pence. You will have read in the newspapers the various reasons to which this increase may be attributed, and I will not say more than to point out a higher price of gold in the terms of all currencies, not only the dollar, would probably be a great stimulus to world trade.

The report and accounts were adopted.

PRINCIPAL SCIENTIFIC OFFICER: DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH. Pensionable post at Warren Spring Laboratory, Stevenage, Herts., for a man or woman for work on Mineral Processing. Qualifications: normally 1st or 2nd Class honours degree or equivalent in mineral processing or chemistry; a knowledge of geology and administrative experience in the mineral processing industry are desirable. Both research and practical experience in the mining industry are essential. Salary scale (men) £1,600-£2,275. Starting pay may be above minimum. Salary subject to review. Write Civil Service Commission, 17 North Audley Street, London, W.1, for application form, quoting **S/5220/60.** Closing date November 30, 1960.

Publications Received

Recursos Minerais do Brasil, 1960. *By Professor Sylviode Fróes Abreu, Director General of the Brazilian Institute of Technology, Rio de Janeiro, Brazil. Price U.S. $1.50 (post free by sea mail).*

This book supplies a want long-felt by students, engineers, industrialists, public men and others for a comprehensive, authoritative compendium of information regarding Brazil's mineral wealth. Owing to the magnitude of the theme the author has divided the work in two parts. The first volume, now published, reveals the actual extent of present-day knowledge regarding Brazil's non-metallic minerals and includes some data concerning other regions of the civilized world, so as to indicate what this country can offer to other nations and what it needs from them to make good its deficiencies.

The second volume, scheduled to appear in 1961, will deal with metallic minerals and fuels.

The Professor's book appears at an opportune moment, in view of the government's programme to increase mineral production and exports. For the success of such a programme, a thorough knowledge of the country's resources is essential. The mass of useful information contained in this first volume will also prove invaluable to the Ministry of Mines and Energy, the new state department created in July last to deal with all matters relating to minerals and energy. These matters have hitherto been subordinate to the Ministries of Agriculture or Labour, neither of which was equipped, or had the time, to deal adequately with such entities as the Institute of Technology, the Department of Mineral Production, the National Council of Mines and Metallurgy, Geological Society, etc.

Volume I describes the geological distribution and production of minerals in Brazil, quotes statistics relating to 1958, lists the metallic and non-metallic minerals in adequate, and in short supply, indicates where certain substances, now lacking, are likely to be found.

Separate chapters are devoted to the raw materials needed by the various industries: the chemical industry, manufacturers of inorganic fertilizers, building materials, ceramics and refractories, mineral pigments, insulating and abrasive minerals, materials for the electric and electronic industries, water power, diamonds and semi-precious stones.

★

Methods devised by the U.S. Bureau of Mines for controlling fires in bituminous-coal refuse piles are described in a report just placed on open file. The report covers laboratory and field studies in which Bureau researchers demonstrated the effectiveness of fine-coal wastes from washeries when applied in layers as a sealing material that inhibits the flow of air through heaps of coal, shale, and other mine refuse. The technique proved useful not only for controlling fires resulting from spontaneous ignition of refuse piles, but also for preventing their occurrence.

Generally, such fires are extremely difficult to control because they eat deeply into refuse dumps and may smoulder for years, beyond the effective reach of water or other extinguishing agents. Many burning refuse piles emit smoke and noxious fumes that cause atmospheric pollution. The Bureau's report can be seen at the Department of the Interior Library, Washington, D.C., and at the Bureau of Mines Pittsburgh Coal-Research Centre, 4800 Forbes Ave., Pittsburgh, Pa. It is entitled *Control of Fires in Coal-Mine Refuse Piles.*

★

A fifth edition (revised May, 1960) of its publication, *Mineral Areas in Cornwall Worthy of Investigation,* has been issued by the Cornish Mining Development Association (price to non-members, one guinea). Of the mineral areas reviewed in this 46 page booklet, eight are listed as potential producers of arsenic, four of copper, five of lead, silver and zinc, 23 of tin, and six of tungsten. These notes, it is stated, by no means exhaust the mineral possibilities of Cornwall, but have been compiled with a view to indicating some of the areas that appear to offer the best prospects for future development. The hon. secretary of the Association is Mr. L. G. Brown, 13 Par Green, Par, Cornwall.

★

The June, 1960 issue of *Industrial Medicine and Surgery* features the 1960 McIntyre Research Foundation Conference on Silicosis and other industrial pulmonary diseases (Vol. 6, No. 29), published by the Industrial Medicine Publishing Co., Miami, Florida.

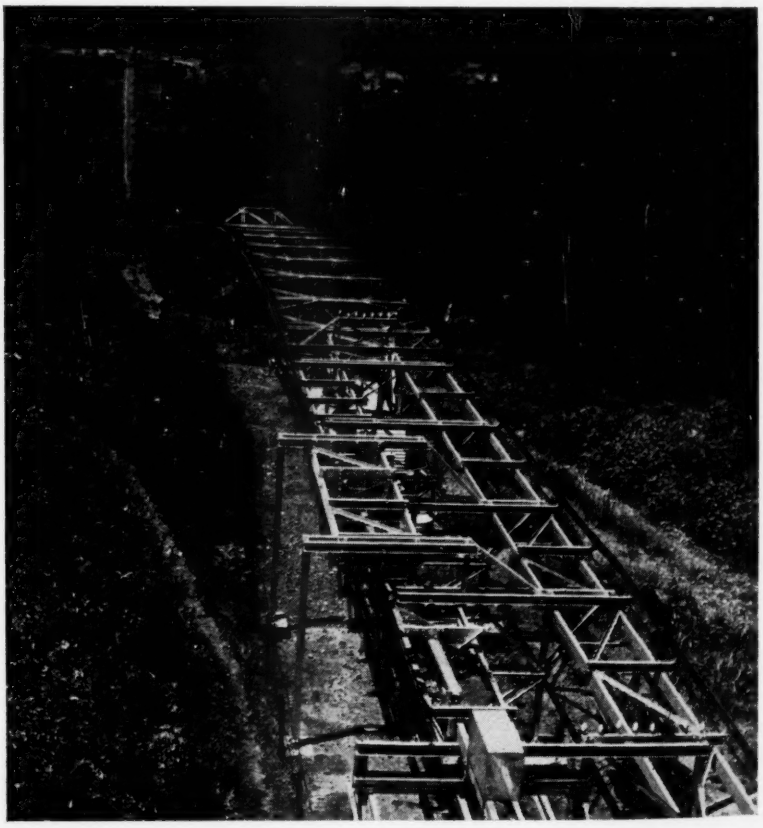
★

The Northern Rhodesian Ministry of Labour and Mines has published the *Records of the Geological Survey* for the year ending December 31, 1958, price £1 1s., which includes articles on the geology of the Petauke and Lusaka urban and rural districts, a radiometric survey in the Northern Province, with tables, plates and maps.

★

The Imperial College of Science and Technology (University of London), has issued its Prospectus 1961-62, covering the Royal College of Science, the Royal School of Mine, and the City and Guilds College.

The ropeway at the Awaso bauxite mine, Ghana. The ropeway is one and a half miles long. Whereas gold mining in Ghana is commonly a deep level underground operation, bauxite, manganese and diamonds are won in opencast workings. Mining is an important industry in Ghana, indeed the Mineworkers' Union of the Ghana Trade Union Congress reports a paid-up membership of just under 38,000



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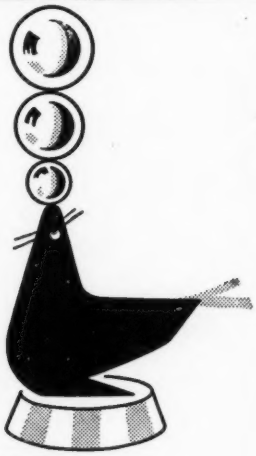

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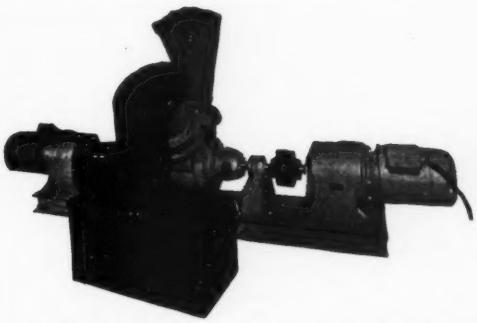

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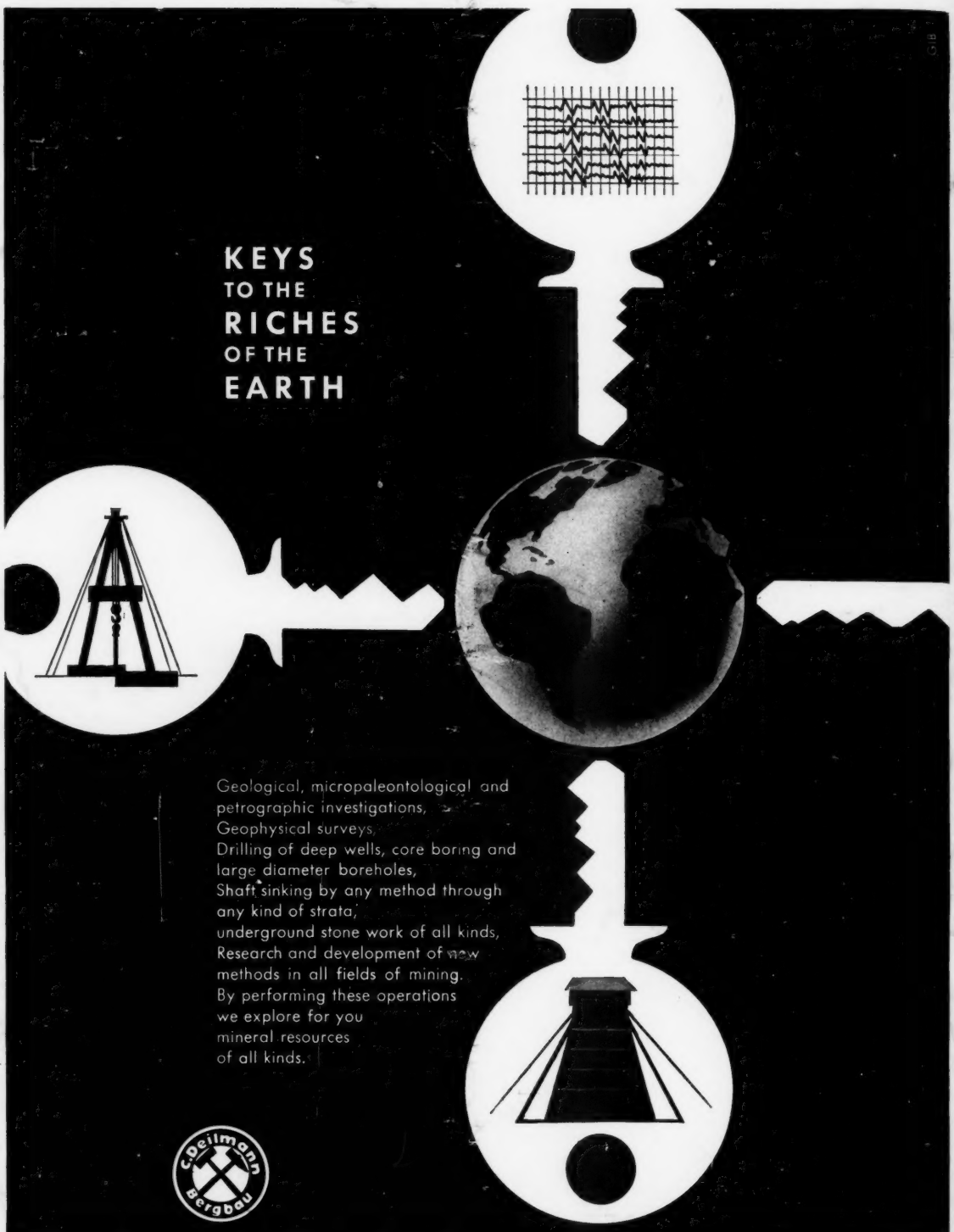
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